Honeywell

UDC 6300 Process Controller Product Manual

51-52-25-45

1/03
Rev. C

Industrial Measurement and Control

Copyright, Notices, and Trademarks

Industrial Measurement and Control
Honeywell Inc.
1100 Virginia Drive
Fort Washington, PA 19034

About This Publication

How this manual is organized

This Product Manual is divided into 11 sections. These sections contain all the information you need to configure, operate, monitor, and troubleshoot your controller.

To find information quickly, use the comprehensive Table of Contents in the front of the manual and the Index located in the back of the manual.

Warranty

The device described herein has been manufactured and tested for correct operation and is warranted as follows:

The Process Controller carries an 18 month warranty. This warranty includes immediate technical assistance via a toll free telephone number and complete replacement of the controller, if necessary.

Contacts

World Wide Web

The following lists Honeywell's World Wide Web sites that will be of interest to our industrial automation and control customers.

Honeywell Organization	WWW Address (URL)
Corporate	*http://www.honeywell.com*
Industrial Measurement and Control	*http://www.honeywell.com/imc*
International	*http://www.honeywell.com/Business/global.asp*

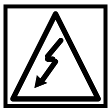
Telephone

Contact us by telephone at the numbers listed below.

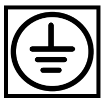
	Organization	Phone Number	
United States and Canada	Honeywell Inc.	1-800-423-9883 1-800-525-7439	Tech. Support Service
Asia Pacific	Honeywell Asia Pacific Inc. Hong Kong	(852) 2829-8298	
Europe	Honeywell PACE, Brussels, Belgium	[32-2] 728-2111	
Latin America	Honeywell Inc., Sunrise, Florida U.S.A.	(954) 845-2600	

Symbol Definitions

This **CAUTION** symbol on the equipment refers the user to the Product Manual for additional information. This symbol appears next to required information in the manual.



WARNING, risk of electric shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible.



Protective earth terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.

Table of Contents

SECTION 1 – OVERVIEW 1

1.1 Introduction 1
1.2 Operator Interface 4

SECTION 2 – INSTALLATION 7

2.1 Overview 7
2.2 Model Number Interpretation 9
2.3 Preliminary Installation Procedure 10
2.4 Mounting 13
2.5 Wiring 15
2.6 Wiring Diagrams 17

SECTION 3 – CONFIGURATION 27

3.1 Overview 27
3.2 Configuration Prompts 28
3.3 How To Get Started 30
3.4 Configuration Tips 31
3.5 Configuration Procedure 32
3.6 Tuning Parameters Set Up Group 34
3.7 Tuning L2 Parameters Set Up Group (Cascade or 2 Loop) 37
3.8 SP Ramp/Program Set Up Group 39
3.9 Accutune Set Up Group 40
3.10 Algorithm Data Set Up Group 42
3.11 Advanced Math Parameters Set Up Group 48
3.12 Output Algorithm Parameters Set Up Group 51
3.13 Input 1 Through 4 Parameters Set Up Group 52
3.14 Input 5 Parameters Set Up Group 53
3.15 Loop 1 Control Parameters Set Up Group 54
3.16 Loop 2 Control Parameters Set Up Group 56
3.17 Options Set Up Group 58
3.18 Communications Group 60
3.19 Alarms Set Up Group 62
3.20 Display Parameters Set Up Group 65
3.21 Calib Group 66
3.22 Status Group 66
3.23 Configuration Record Sheet 67

SECTION 4 – CONFIGURATION PROMPT DEFINITIONS 71

4.1 Overview 71
4.2 Tuning Parameters Set Up Group 72
4.3 Tuning Loop 2 Parameters Set Up Group 76
4.4 Setpoint Ramp/Rate Set Up Group 77
4.5 Accutune Set Up Group 79
4.6 Algorithm Data Set Up Group 82
4.7 Advanced Math Parameters Set Up Group 98
4.8 Output Algorithm Parameters Set Up Group 104
4.9 Input 1 Through 4 Parameters Set Up Group 106
4.10 Input 5 Parameters Set Up Group 108
4.11 Control Parameters Set Up Group 111
4.12 Control2 Parameters Set Up Group 116
4.13 Options Set Up Group 120
4.14 Communications Set Up Group 128
4.15 Alarms Set Up Group 133

Table of Contents, continued

4.16 Display Parameters Set Up Group 138
4.17 Calibration Data 141
4.18 Status Test Data 141

SECTION 5 – OPERATION 143

5.1 Overview 143
5.2 How to Power Up The Controller 144
5.3 Enter a Security Code 146
5.4 Monitoring Your Controller 147
5.5 Start Up Procedure 153
5.6 Operating Modes 154
5.7 Setpoints 158
5.8 Setpoint Rate 165
5.9 Single Setpoint Ramp 166
5.10 Using Two Set of Tuning Constants 169
5.11 2 Loops of Control Overview 172
5.12 Configure 2 Loop of Control 177
5.13 Monitor 2 Loops of Control 180
5.14 Operate 2 Loops of Control 183
5.15 Input Math Algorithms 184
5.16 Logic Gate Operation 187
5.17 Digital Outputs 189
5.18 Digital Input Option (Remote Switching) 192
5.19 Fuzzy Overshoot Suppression 198
5.20 Accutune™ 199
5.21 Input 5 - Pulse Input 208
5.22 Three Position Step Control 210
5.23 Auto/Manual Station 212

SECTION 6 – INPUT CALIBRATION 217

6.1 Overview 217
6.2 Minimum and Maximum Range Values 218
6.3 Input 1, 2, 3, or 4 Preliminary Information 219
6.4 Input 1, 2, 3, or 4 Set Up Wiring 221
6.5 Input #1, 2, 3, or 4 Calibration Procedure 222
6.6 Input 5 - Low Level Inputs Preliminary Information 224
6.7 Input #5 - Low Level Inputs Set Up Wiring 226
6.8 Input #5 - Low Level Inputs Calibration Procedure 230
6.9 Input #5 - Pulse Input Preliminary Information 232
6.10 Input #5 - Pulse Input Calibration Procedure 233
6.11 Input #5 - Pulse Input Verification 235
6.12 Restoring Factory Calibration 236

SECTION 7 – OUTPUT CALIBRATION 241

7.1 Overview 241
7.2 Current Proportional Output Calibration 242
7.3 2nd Current Output 245

SECTION 8 – TROUBLESHOOTING / SERVICE 249

8.1 Overview 249
8.2 Troubleshooting Aids 251
8.3 Power-up Tests 253
8.4 Status Tests 254
8.5 Background Tests 257
8.6 Controller Failure Symptoms 259

Table of Contents, continued

8.7 Troubleshooting Procedures 260

8.8 Parts Replacement Procedures 266
8.9 Maintenance 277

SECTION 9 – PARTS LIST 279
9.1 Exploded View 279

Figures

Figure 1-1 Operator Interface Displays and Indicators 4
Figure 2-1 Model Number Interpretation 9
Figure 2-2 Power Select Jumper Placement 11
Figure 2-3 Dimensions 13
Figure 2-4 Composite Wiring Diagram 17
Figure 2-5 Line Voltage Wiring 18
Figure 2-6 High Level Input Connections 19
Figure 2-7 Optional Input 5, Low level Input Connections 20
Figure 2-8 Optional Input 5-Pulse Input Connections 21
Figure 2-9 Current Output Connections 22
Figure 2-10 Second Current Output Connections 23
Figure 2-11 Digital Input Connections 24
Figure 2-12 Digital Output Connections 25
Figure 2-13 Communications Option Connections 26
Figure 3-1 Overview of UDC6300 Prompt Hierarchy 28
Figure 4-1 Example of Mass Flow Compensation using Multiplier/Divider Algorithm 95
Figure 4-2 Example of Eight Segment Characterizer 97
Figure 5-1 Operator Interface 147
Figure 5-2 Functional Overview Block Diagram of a Single Loop Controller - Loop #1 173
Figure 5-3 Functional Overview Block Diagram of Loop 2 of a 2 Loop Controller 174
Figure 5-4 Functional Overview Block Diagram of Internal Cascade of a 2 Loop Controller 175
Figure 5-5 Hi/Lo Override Selector 176
Figure 5-5 Auto/Manual Station Using Digital Input #1 and Backup Control Feature 212
Figure 6-1 Input #1, 2, 3, or 4 Wiring Terminals 219
Figure 6-2 Wiring Connections for 1 to 5 Volts or 4 to 20 mA 221
Figure 6-3 Input #5 - Low Level Inputs Wiring Terminals 224
Figure 6-4 Wiring Connections for Thermocouple Inputs Using an Ice Bath 226
Figure 6-5 Wiring Connections for Thermocouple Inputs Using a Precision Resistor 227
Figure 6-6 Wiring Connections for RTD (Resistance Thermometer Device) 228
Figure 6-7 Wiring Connections for Radiamatic, Millivolts, Volts, or Milliamps 229
Figure 6-8 Test Equipment connections for Calibrating Pulse Inputs 235
Figure 7-1 Wiring Connections for Calibrating Current Proportional Output 243
Figure 7-2 Wiring Connections for Calibrating 2nd Current Output 246
Figure 8-1 Chassis Removal 267
Figure 8-3 Bezel/Keyboard/Display Assembly 270
Figure 8-4 Keyboard and Display Board Removal 270
Figure 8-2 Replacement Parts Identification 268
Figure 8-5 Printed Wiring Board Identification 271
Figure 8-6 Power Select Jumper Location 273
Figure 9-1 UDC 6300 Exploded View 279

Tables

Table 1-1 Function of Keys....5
Table 2-1 Operating Limits....8
Table 2-2 Preliminary Installation Procedure....10
Table 2-3 Mounting Procedure....14
Table 2-4 Permissible Wiring Bundling....15
Table 3-1 Configuration Tips....31
Table 3-2 Configuration Procedure....32
Table 3-3 Tuning Group Function Prompts....35
Table 3-4 Tuning L2 Group Function Prompts....37
Table 3-5 SP Ramp Group Function Prompts....39
Table 3-6 Accutune Group Function Prompts....41
Table 3-7 Algorithm Group Function Prompts....42
Table 3-8 Advanced Math Group Function Prompts....48
Table 3-9 Output Algorithm Group Function Prompts....51
Table 3-10 Input 1 through 4 Set Up Groups Function Prompts....52
Table 3-11 Input 5 Group Function Prompts....53
Table 3-12 Control Group Function Prompts....54
Table 3-13 Control2 Group Function Prompts....56
Table 3-14 Options Group Function Prompts....58
Table 3-15 Commun Group Function Prompts....60
Table 3-16 Alarms Group Function Prompts....62
Table 3-17 Display Group Function Prompts....65
Table 4-1 Tuning Group Prompt Definitions....72
Table 4-2 Tuning L2 (Loop 2) Group Prompt Definitions....76
Table 4-3 Setpoint Ramp/Rate Group Definitions....77
Table 4-4 Accutune Group Definitions....79
Table 4-5 Algorithm Group Definitions....82
Table 4-6 Advanced Math Group Definitions....98
Table 4-7 Output Algorithm Group Definitions....104
Table 4-8 Input 1 through 4 Group Definitions....106
Table 4-9 Input 5 Group Definitions....108
Table 4-10 Control Group Definitions....111
Table 4-11 Control2 Group Definitions....116
Table 4-12 Option Group Definitions....120
Table 4-13 Communications Group Definitions....128
Table 4-14 Alarms Group Definitions....133
Table 4-15 Latching and Non-latching Alarm Configuration....137
Table 4-16 Display Group Definitions....138
Table 5-1 Power Up Diagnostic Tests....144
Table 5-2 Procedure for Testing the Displays and Keys....145
Table 5-3 Procedure for Entering a Security Code....146
Table 5-4 Lower Display Key Parameter Prompts....150
Table 5-5 Error Messages....152
Table 5-6 Procedure for Starting Up the Controller....153
Table 5-7 Operating Mode Definitions....154
Table 5-8 Changing Operating Modes....155
Table 5-9 Procedure for Selecting Automatic or Manual Mode....156
Table 5-10 Procedure for Selecting the Local Setpoint Source....158
Table 5-11 Procedure for Changing the Local Setpoints....159
Table 5-12 Procedure for Switching Between Local Setpoint 1 and 2....160
Table 5-13 Procedure for Switching Between Local Setpoint 3 and Local Setpoint 1 or 2....161
Table 5-14 Procedure for Selecting the Remote Setpoint Source....162
Table 5-15 Procedure for Switching Between Local and Remote Setpoints....163
Table 5-16 Setpoint Selection Indication....164

Tables, continued

Table 5-17	Procedure for Configuring a Setpoint Ramp	166
Table 5-18	Procedure for Running a Setpoint Ramp	167
Table 5-19	Procedure for Selecting Two Set of Tuning Constants	169
Table 5-20	Procedure for Setting Switchover Values	170
Table 5-21	Procedure for Setting Tuning Constant Values	170
Table 5-22	Procedure for switching PID SETS from the Keyboard	171
Table 5-23	Control Loop Selections	172
Table 5-24	Procedure for Selecting 2 Loop Algorithm	177
Table 5-25	Procedure for Selecting Output Algorithm	177
Table 5-26	Procedure for Selecting Control Parameters	178
Table 5-27	Procedure for Selecting Tuning Parameters	179
Table 5-28	Digital Display Indication - 2 Loops	180
Table 5-29	Bargraph Indication - 2 Loops	181
Table 5-30	Logic Gates Constraints and Dynamic Operation Status	188
Table 5-31	Latching and Non-Latching Alarm Operation	189
Table 5-32	Digital Input 1 and 2 Option Action on Contact Closure	192
Table 5-33	Digital Input Combinations “DIG IN 1”	194
Table 5-34	Digital Input Combinations “DIG IN 2”	194
Table 5-35	Digital Input 1 and 2 Combination Operation	195
Table 5-36	Digital Input 3, 4, 5, 6 Option Action on Contact Closure	196
Table 5-37	Accutune Rules and Regulations	200
Table 5-38	Procedure for Starting TUNE (Demand) Tuning	201
Table 5-39	Procedure for Using TUNE at Start-up for Duplex	202
Table 5-40	Procedure for Using SP Only Tuning at Start-up	203
Table 5-41	Procedure for Using SP Tuning at Start-up for Duplex	204
Table 5-42	Adaptive Tune Error Prompt Definitions	207
Table 5-43	Controller Configuration Selections for Pulse Input	209
Table 5-44	Procedure for Setting the 3PSTEP Motor time	210
Table 5-45	Procedure for Displaying the 3PSTEP Motor Position	211
Table 5-46	Auto/Manual Station Mode Configuration Procedure	214
Table 6-1	Voltage and Resistance Equivalents for 0% and 100% Range Values	218
Table 6-10	Restoring Factory Calibration	236
Table 6-2	Equipment Needed	220
Table 6-3	Input #1, 2, 3, or 4 Calibration Procedure	222
Table 6-4	Equipment Needed	225
Table 6-5	Set Up Wiring Procedure for Thermocouple Inputs Using An Ice Bath	226
Table 6-6	Set Up Wiring Procedure for Thermocouple Inputs Using a Precision Resistor	227
Table 6-7	Input #5 Calibration Procedure	230
Table 6-8	Input #5 - Pulse Input Calibration Procedure	233
Table 6-9	Pulse Input Verification Setup	235
Table 7-1	Set Up Wiring Procedure Current Proportional Output	242
Table 7-2	Current Proportional Output Calibration Procedure	244
Table 7-3	Set Up Wiring Procedure for 2nd Current Output	245
Table 7-4	2nd Current Output Calibration Procedure	247
Table 8-1	Error Message Prompts	251
Table 8-2	Procedure for Identifying the Software Version	252
Table 8-4	Procedure for Displaying the Status Tests Results	254
Table 8-5	Status Tests	255
Table 8-6	Background Tests	257
Table 8-7	Controller Failure Symptoms	259
Table 8-8	Troubleshooting Power Failure Symptoms	260
Table 8-9	Troubleshooting Current Proportional Output Failure	261
Table 8-10	Troubleshooting Time Proportional Digital Output(s) Failure	262
Table 8-11	Troubleshooting Alarm Digital Output(s) Failure	263
Table 8-12	Troubleshooting a Keyboard Failure	264

Tables, continued

Table 8-13	Troubleshooting a DMCS Communications Failure	265

Table 8-14 How to Remove the Chassis 267
Table 8-15 Bezel/Keyboard/Display Assembly Replacement Procedure 269
Table 8-16 Access the Printed Wiring Boards..................... 271
Table 8-17 MCU/Inputs PWB Replacement Procedure 272
Table 8-18 Communications Option Board Replacement Procedure 274
Table 8-19 Digital I/O PWB Replacement Procedure 275
Table 8-20 Option Input Board Replacement Procedure 276
Table 9-1 Parts Identification..................... 280
Table 9-2 Parts Not Shown..................... 281
Table 9-3 Gray Vutronik Mask Kits..................... 281

Acronyms

3PSTEP........ 3 Position Step Control
EMI........ Electromagnetic interference
HID........ high intensity discharge
MOVs........ Metal Oxide Varistors
PID........ Proportional, Integral, and Derivative
RC........ resistance-capacitance
RFI........ Radio frequency interference
RH........ Relative Humidity
RTD........ Resistance Thermometer Device
SCRs........ Silicon controlled rectifiers
UDC........ Process Controller

References

Publication Title	Publication Number
UDC3000/UDC5000/UDC6000/UDC6300 RS422/485 Communications Option Manual	51-51-25-35
UDC6300 MODBUS 485RTU Communications Option manual	51-51-25-53
PM/APM UDC6300 Integration Manual	PM12-520

Section 1 – Overview

1.1 Introduction

Function

The UDC 6300 Process Controller is a microprocessor-based controller that handles basic control strategies and is easily upgraded to higher functionality to meet advanced control strategies such as 2 Loops of control, Cascade, Feedforward control or those requiring logic or math functions.

The controller has four high-level, and an optional low level, isolated loop related analog input signals.

The controller produces current outputs and four Digital Outputs or Digital Inputs based on operator-entered data plus two more dedicated Digital Inputs.

See the block diagrams for:

- One loop of control - Figure 5-2
- Two loops of control - Figure 5-3
- Internal Cascade control - Figure 5-4

CE Conformity (Europe)

This product is in conformity with the protection requirements of the following European Council Directives: **73/23/EEC**, the Low Voltage Directive, and **89/336/EEC**, the EMC Directive. Conformity of this product with any other “CE Mark” Directive(s) shall not be assumed.

Deviation from the installation conditions specified in this manual, and the special conditions for CE conformity in Section 2.1, may invalidate this product’s conformity with the Low Voltage and EMC Directives.

ATTENTION

The emission limits of EN 50081-2 are designed to provide reasonable protection against harmful interference when this equipment is operated in an industrial environment. Operation of this equipment in a residential area may cause harmful interference. This equipment generates, uses, and can radiate radio frequency energy and may cause interference to radio and television reception when the equipment is used closer than 30 meters (98 feet) to the antenna(e). In special cases, when highly susceptible apparatus is used in close proximity, the user may have to employ additional mitigating measures to further reduce the electromagnetic emissions of this equipment.

Continued on next page

Inputs

Four high-level inputs are standard. They can be:

- 1 to 5 Volts,
- 4 to 20 mA, or
- 10 to 50 mA

A fifth input is available as an option and can be one of several types:
• a low-level Thermocouple or RTD sensor
• a linear input (mA, Volts, mV, or Radiamatic)
• a pulse counter input for use with frequency output devices. This Pulse counter input can be used as a frequency input or as a setpoint adjustment input whereby each pulse is counted as one least significant digit change to the setpoint. A digital input selection determines the direction of setpoint change.

Any input can be used as:
• the process variable for either loop
• remote setpoint signal
• for computing the weighted average of two inputs
• Input for Math algorithms such as feedforward Summer or Multiplier, Input Summing with Ratio and Bias, HI/LO Input Select with Ratio and Bias, Multiplier/Divider.

Outputs

The controller has a current output and is available with an optional second current output for control, or a signal representing any of several controller parameters for control or recording purposes.

Output Algorithms

Depending on how many loops you configure, the UDC6300 is available with various preselected output algorithms including:

- On/Off,
- On/Off Duplex,
- Time Proportional Simplex or Duplex,
- Current Proportional Simplex or Duplex,
- Current/Time Duplex.

Digital Inputs / Outputs

Four points, each of which can be an open-collector type Digital Output for alarm and control, or a Digital Input. There are also two dedicated Digital Inputs.

Continued on next page

Control Algorithms

Depending on the Control output type specified, the controller can be configured for the following control algorithms:

- On/Off control,
- PID-A Equation,
- PID-B Equation,
- PD with Manual Reset.
- 3 Position Step Control

Duplex control can be configured for all algorithms except 3 Pos Step.

Options

Available options include:

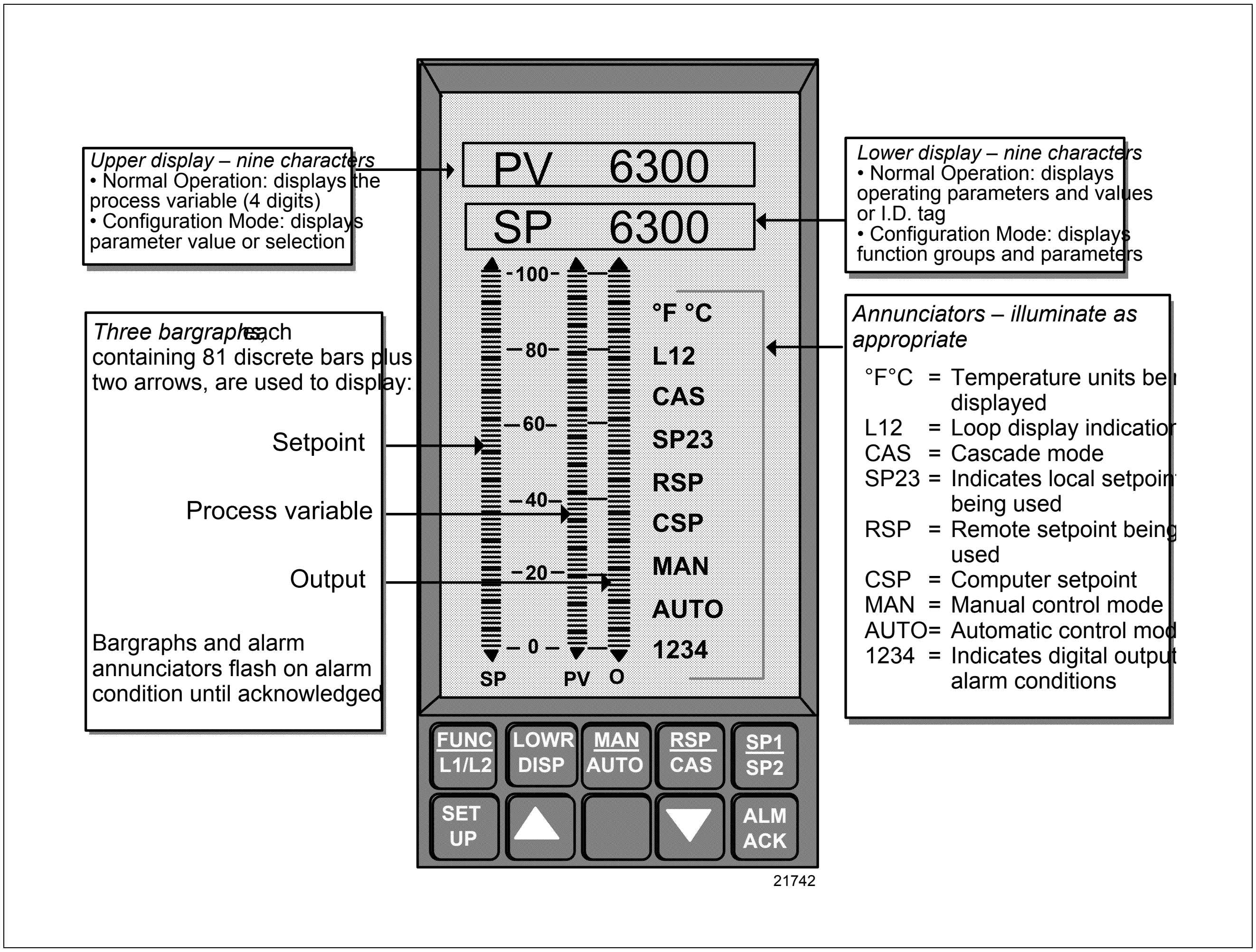
Dual Loop / Internal Cascade	Two independent loops of control or internal cascade linking of the primary and secondary controller in one device. Includes output override algorithm.
Accutune	Automatically adjusts the PID tuning parameters as necessary while controlling at setpoint in the automatic control mode.
Second Current Output	Fully isolated and configurable as control output or auxiliary output
Transmitter Power	24Vdc power to supply one or two, 4 to 20mA transmitters for the high level inputs.
Communications	Serial communications link integrates with CRT-based RS422/485 or DMCS.
Math Options	Two pre-configured algorithms have easy implementation into either control loop. They can be linked or used individually and are capable of using any input with its' Ratio and Bias. *Gain Scheduling* - 8 Gain values may be applied to 8 Process Variable (PV) bands for use on known non-linear processes. *Two 8-Segment Characterizers* - can be applied to Input 2, Input 4, Loop 1 Output, or Loop 2 Output. *Polynomial Curve Characterizer*-- a fifth order polynomial equation can be used on any one of the five analog inputs. *Totalizer Function* - displays actual current totalized value of up to 8 digits. *Digital Logic Gates* - up to 5 gates can be configured. For each gate you can select from 8 gate types; each gate having two input sources and one output use.

1.2 Operator Interface

Displays and indicators

Figure 1-1 shows the operator interface and defines the displays and indicators. The function of the keys is shown in Table 1-1.

Figure 1-1 Operator Interface Displays and Indicators



Continued on next page

1.2 Operator Interface, Continued

Function of keys

Table 1-1 shows each key on the operator interface and defines its function.

Table 1-1 Function of Keys

Key	Function
SET UP	• Places the controller in the Configuration Set Up group select mode. Sequentially displays Set Up groups and allows the FUNC key to display individual functions in each Set Up group. • A manual check of all the displays can be invoked. Press the SET UP key and hold in, then press FUNC key. All segments of the displays will be illuminated.
FUNC / L1/L2	• Used in conjunction with the SET UP key to select the individual functions of a selected Configuration Set Up group. • Press the FUNC key and ▲ key to start/halt setpoint ramp • Also toggles between Loop 1 and Loop 2 display.
LOWR DISP	• Selects any one of 26 operating parameter to be shown in the lower display. See subsection 5.4 for list. • Used to exit Set Up.
MAN / AUTO	• Alternately selects: AUTO Lower display automatically displays setpoint value in engineering units. MAN Lower display automatically indicates output in %.
RSP / CAS	• Alternately selects Local Setpoint 1 and Remote Setpoint or Local Setpoint 3. • Changes the controller from local to remote and vice versa. • Also, switches into or out of Internal Cascade Control.
SP1 / SP2	• Toggles between Local Setpoint #1 and #2.
ALM ACK	• Press to acknowledge new alarm condition and stop bargraph flashing. • Provides direct access to alarm group.
▲	• Increases the setpoint, output, or configuration values displayed. The value displayed is entered by advancing to the next display.
▼	• Decreases the setpoint, output, or configuration values displayed. The value displayed is entered by advancing to the next display.

Section 2 – Installation

2.1 Overview

Introduction

Installation of the controller consists of mounting and wiring the controller according to the instructions given in this section. The Process Controller is industrial control equipment that must be panel mounted. The wiring terminals must be enclosed within the panel.

Read the pre-installation information, check the model number interpretation and become familiar with your model selections, then proceed with installation.

What's in this section?

This section contains the following information:

Topic	See Page
2.1 Overview	7
2.2 Model Number Interpretation	9
2.3 Preliminary Installation Procedure	10
2.4 Mounting	13
2.5 Wiring	15
2.6 Wiring Diagrams	17

Controller Replacement

If you are replacing a UDC6000 or an existing UDC6300 you can keep the old configuration data by removing the EEPROM from the old unit and placing it in the new unit. Refer to Subsection 8.8 for location of the EEPROM and instructions.

Continued on next page

Pre-installation information

If the controller has not been removed from its shipping carton, inspect the carton for damage and remove the controller. Inspect the unit for any obvious shipping damage and report any damage due to transit to the carrier.

Make sure a bag containing mounting hardware is included in the carton with the controller.

Check that the model number shown on the inside of the case agrees with what you have ordered.

CE Conformity special conditions (Europe)

Shielded twisted pair cables are required for all Analog I/O, Process Variable, RTD, Thermocouple, dc millivolt, low level signal, 4-20 mA, Digital I/O, and computer interface circuits. For performance Criterion A under special conditions, DO NOT set alarm outputs to LATCHING (ref. Sections 3.19, 4.15, and 5.17)
Refer to Appendix B - Severe Electrical Noise Environments for additional installation guidance.

Operating limits

We recommend that you review and adhere to the operating limits listed in Table 2-1 when you install your controller.

Table 2-1 Operating Limits

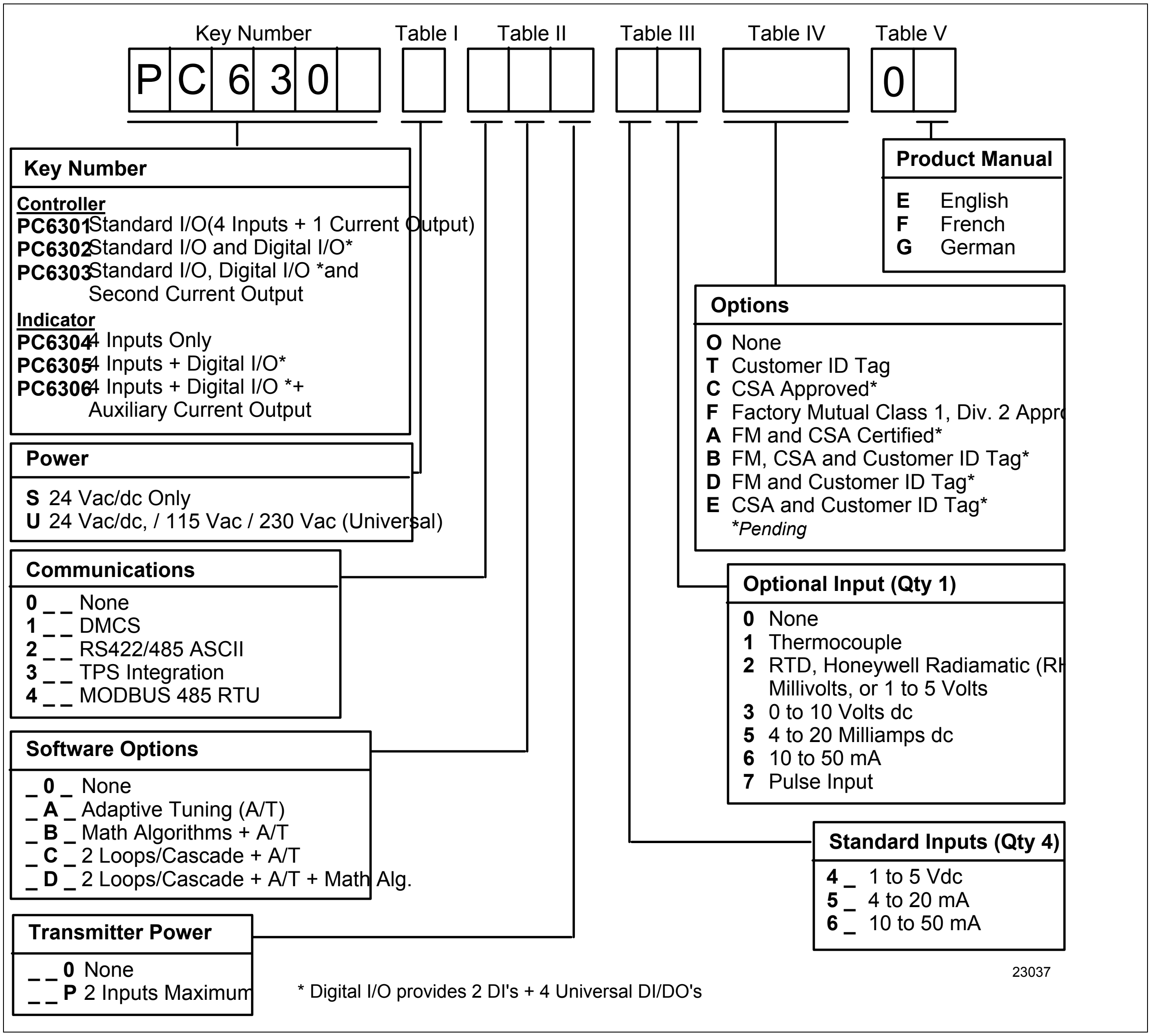
Condition	Specifications
Ambient Temperature	32 to 140°F (0 to 60°C)
Relative Humidity	5 to 90% RH at 40°C (104°F)
Vibration Frequency Acceleration	 0 to 200Hz 0.2g
Mechanical Shock Acceleration Duration	 5g 30ms
Power Voltage Frequency(Hz)	 20 to 30 Vac/dc 96 to 132 Vac 192 to 264 Vac 49 to 51 59 to 61
Transmitter Supply Voltage (at input terminals)	22 to 26 Vdc @ 50mA
Power Consumption	20VA Maximum

2.2 Model Number Interpretation

Model number

The model number interpretation is shown in Figure 2-1. Write the model number into the spaces provided and compare it to the model number interpretation. This information will also be useful when you wire your controller.

Figure 2-1 Model Number Interpretation



2.3 Preliminary Installation Procedure

Introduction

Before you install the controller, you must check your Input Range selection (standard and optional).

Procedure

Two power select jumpers are supplied with the controller are supplied with the controller.

Refer to Figure 2-2 for jumper location and follow the procedure in Table 2-2 to install them.

Table 2-2 Preliminary Installation Procedure

Step	Action
1	Loosen the front screw and pull the chassis out of the case.
2	Lay the chassis on a non-conductive surface.
3	Install the two power select jumpers, supplied with the kit, into the correct position on the MCU/Input printed wiring board. See Figure 2-2 for the correct position for the Voltage being used.
4	Replace the controller chassis into the case and tighten the screw.

Continued on next page

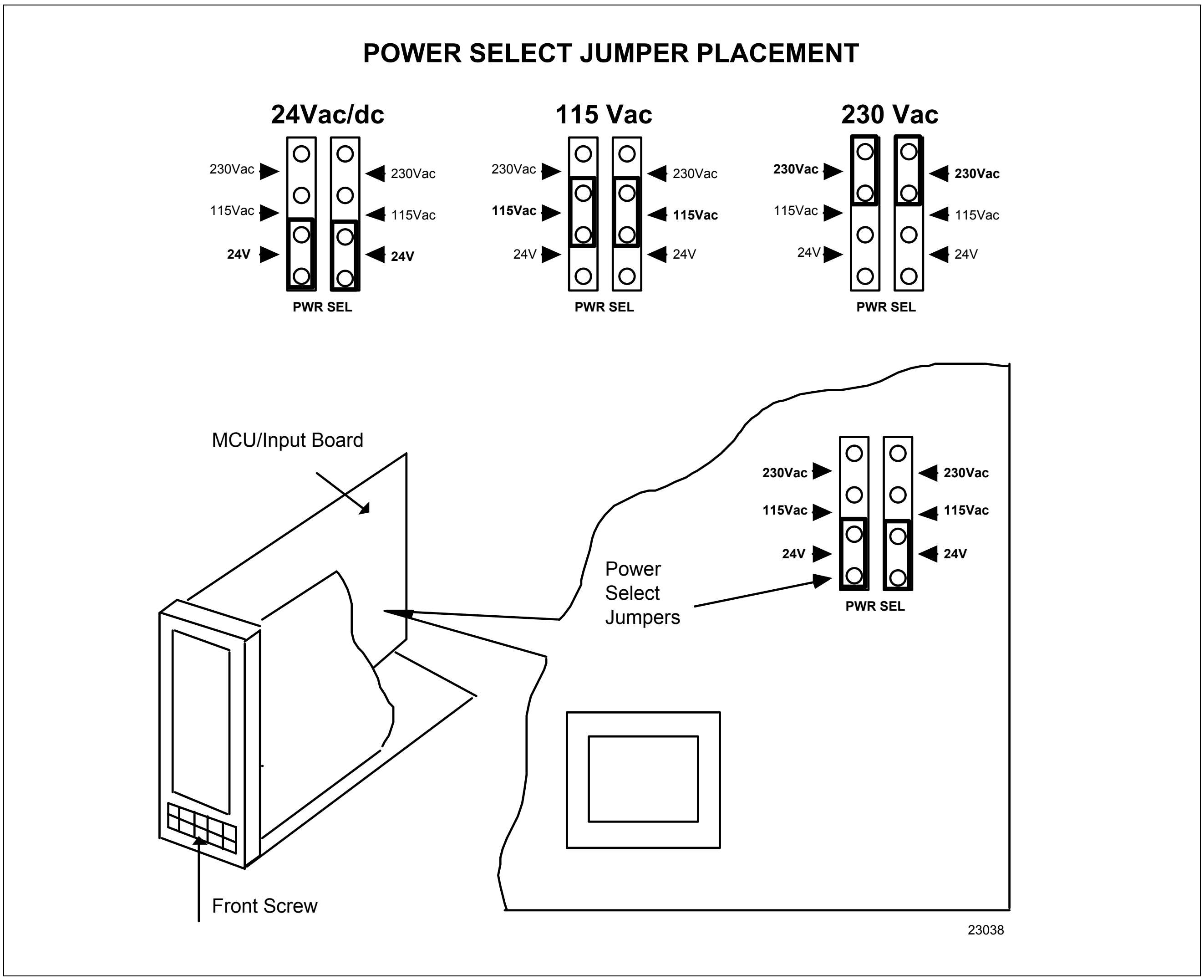
Power select jumper placement

This controller requires a specific fuse and power jumper position if its model number is DC630X-U-XXX-XX-X-XX.
Figure 2-2 shows you the locations of the Power Select Jumper. It also shows you where to place the jumper for your particular Voltage being used.

- **115 Vac** **315 mA Fuse** The controller is shipped with this fuse installed and the Power Select jumper set in the 115 Vac position.
- **230 Vac** **200 mA Fuse** Fuse included in separate bag.
- **24 Vac/dc** **800 mA Fuse** Fuse included in separate bag.

CAUTION **Applying the wrong power to the controller will severely damage the controller and is a fire and smoke hazard. Make sure the jumpers are set correctly.**

Figure 2-2 Power Select Jumper Placement



Continued on next page

Standard inputs range selection (Inputs 1 through 4)

The controller will be shipped set up for a range of 1 to 5 Volts.
If a 4 to 20 or 10 to 50 mA was specified (ordered), a kit of 5 resistors for the appropriate range will be included in the shipping box. These must be attached to the proper terminals as shown in Figure 2-6. The kit numbers are:

4 to 20 mA	Kit # 30755498-001	(250 Ohm Resistor)
10 to 50 mA	Kit # 30755498-002	(100 Ohm Resistor)

Optional input 5 range selection (Low Level Input)

If an Input 5 - Low Level is ordered, kits will be supplied containing:

•A Cold Junction Resistor for Thermocouple ranges Kit # 30757088-501
•A Voltage Divider Assembly for 0 to 10 Volt ranges Kit # 30754465-001
•A 250 ohm Precision Resistor for 4 to 20 mA ranges Kit # 30755498-001
•A 100 ohm Precision Resistor for 10 to 50 mA ranges Kit # 30755498-002

Attach the resistor for your specific range to the Input 5 terminals as shown in Figure 2-7.

Electrical considerations

The controller is considered "rack and panel mounted equipment" per EN 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements. Conformity with 72/23/EEC, the Low Voltage Directive requires the user to provide adequate protection against a shock hazard. The user shall install this controller in an enclosure that limits OPERATOR access to the rear terminals.

Controller grounding

PROTECTIVE BONDING (grounding) of this controller and the enclosure in which it is installed shall be in accordance with National and local electrical codes. To minimize electrical noise and transients that may adversely affect the system, supplementary bonding of the controller enclosure to a local ground, using a No. 12 (4 mm^2) copper conductor, is recommended.

2.4 Mounting

Physical considerations

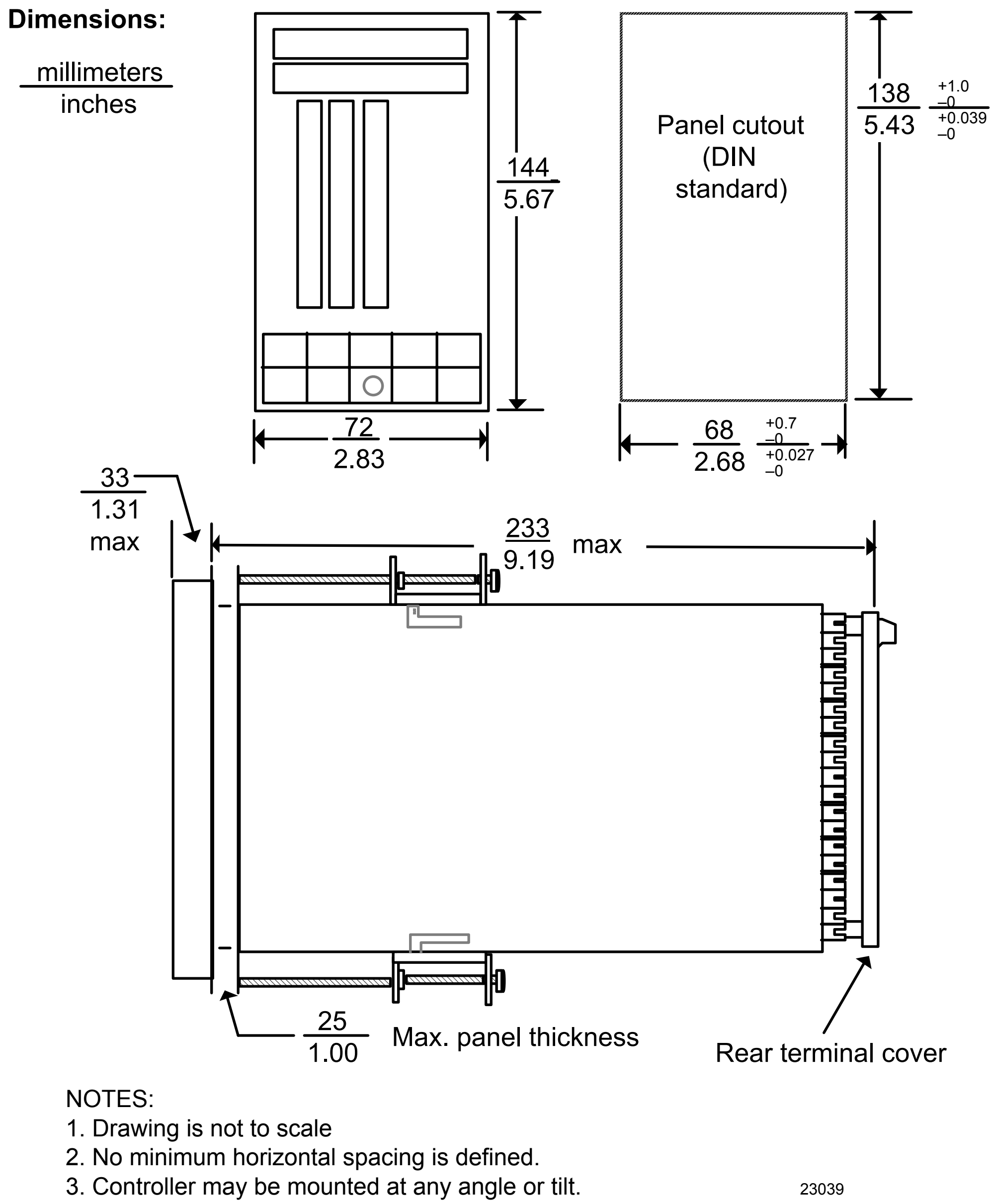
The controller can be mounted on either a vertical or tilted panel using the mounting kit supplied. Adequate access space must be available at the back of the panel for installation and servicing activities.

The overall dimensions and panel cutout requirements for mounting the controller are shown in Figure 2-3.

Overall dimensions

Figure 2-3 shows the overall dimensions for mounting the controller.

Figure 2-3 Dimensions



Continued on next page

Note Model Number

Before mounting the controller, refer to the nameplate on the inside of the case and make a note of the model number. It will help later when selecting the proper wiring configuration.

Mounting procedure

Follow the procedure In Table 2-3 below to mount the controller.

Table 2-3 Mounting Procedure

Step	Action
1	Mark and cut out the controller hole in the panel according to the dimension information in Figure 2-3. There is no minimum horizontal spacing defined. Vertical spacing must be provided for access to the mounting kit brackets.
2	Remove the screw cover and loosen the screw on the front of the controller. Pull the chassis out of the case.
3	Orient the case properly and slide it through the panel hole from the front.
4	Remove the mounting kit (#30755050-001) from the shipping container, and install the kit as follows: • Install the screws into the threaded holes of the clips. • Insert the prongs of the clips into the two holes in the top and bottom of the case. • Tighten both screws to secure the case against the panel. • Carefully slide the chassis assembly into the case, press to close and tighten the screw. Replace the screw cover.
5	In addition to the mounting kit, a Rear Terminal Cover Kit (#30755496-001) is also provided.

2.5 Wiring

Taking electrical noise precautions

Electrical noise is composed of unabated electrical signals which produce undesirable effects in measurements and control circuits.

Digital equipment is especially sensitive to the effects of electrical noise. Your controller has built-in circuits to reduce the effect of electrical noise from various sources. If there is a need to further reduce these effects:

- Separate External Wiring - separate connecting wires into bundles (see Table 2-4) and route the individual bundles through separate conduits or metal trays.
- Use Suppression Devices - for additional noise protection, you may want to add suppression devices at the external source. Appropriate suppression devices are commercially available.

NOTE For additional noise information, refer to *Appendix B*.

Permissible wire bundling

Table 2-4 shows which wire functions should be bundled together.

Table 2-4 Permissible Wiring Bundling

Bundle No.	Wire Functions
1	• Line power wiring • Earth ground wiring • Control relay output wiring • Line voltage alarm wiring
2	Analog signal wire, such as: • Input signal wire (thermocouple, 4 to 20 mA, etc.) • 4-20mA output signal wiring • Slidewire feedback circuit wiring • Digital input signals • Communications
3	• Low voltage alarm relay output wiring • Low voltage wiring to solid state type control circuits

Continued on next page

Identify your wiring requirements

To determine the appropriate diagrams for wiring your controller, refer to the model number interpretation in this section. The model number of the controller contains selection codes that identify the Input/Output type, Standard Input Range, Optional 5th Input type, Software Options, and Optional selections. The model number of the controller can be found on the outside of the case and/or chassis.

Wiring the controller

Using the information contained in the model number, select the appropriate wiring diagrams from the figures listed below and wire the controller accordingly.

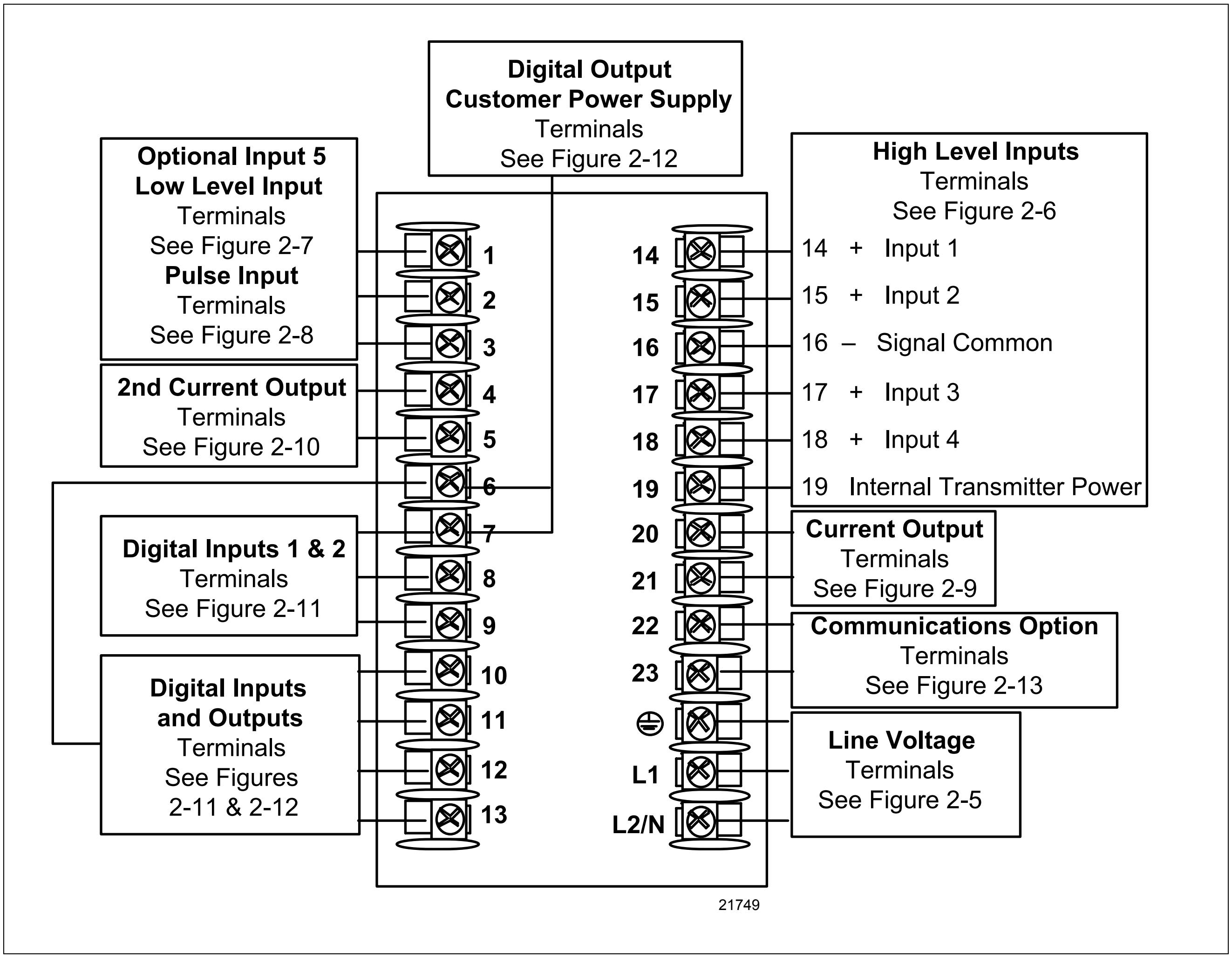
Wiring Requirements	Figure
Composite Wiring Diagram	2-4
AC Line Power	2-5
High Level Inputs - Inputs #1, #2, #3, #4	2-6
Optional Input 5 - Low Level Inputs	2-7
Optional Input 5 - Pulse Inputs	2-8
Current Output	2-9
Second Current Output	2-10
Digital Inputs	2-11
Digital Outputs	2-12
Communications Option	2-13

2.6 Wiring Diagrams

Composite wiring diagram

Figure 2-4 is a composite wiring diagram of the UDC6300 controller. It identifies the terminal designations and their functions. Refer to the individual diagrams listed to wire the controller according to your requirements.

Figure 2-4 Composite Wiring Diagram



Continued on next page

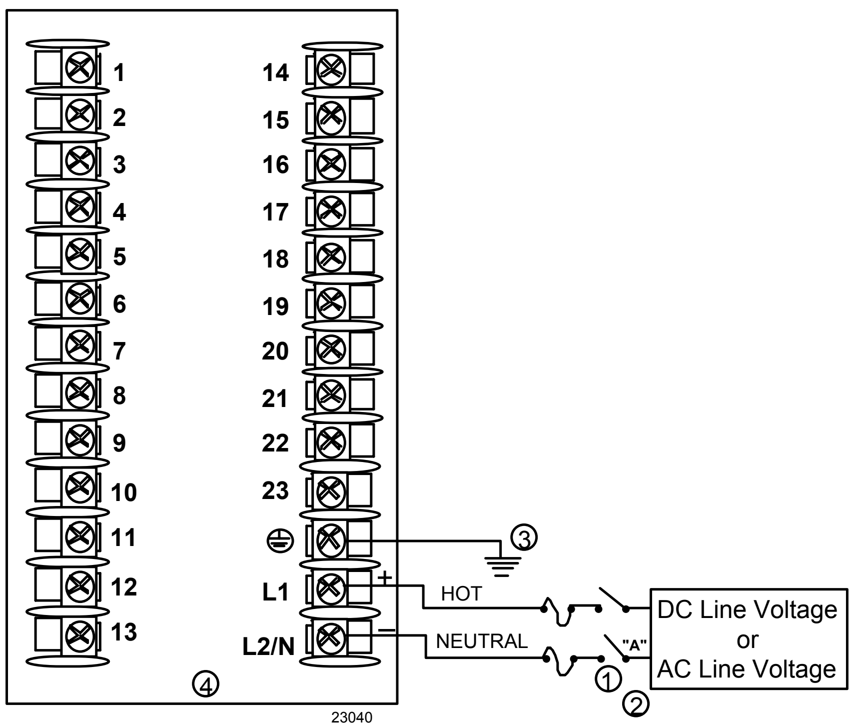
Line voltage wiring

This equipment is suitable for connection to 24Vac/dc or 115/230 Vac, 50/60 Hz, power supply mains. When connected to 115/230 Vac, 50/60 Hz, power supply mains, it is the user's responsibility to provide a switch and slow-blow (North America), quick-acting, high breaking capacity, Type F, (Europe) 1/2 A, 250 V fuse(s) or circuit-breaker as part of the installation. The switch or circuit-breaker shall be located in close proximity to the controller, within easy reach of the OPERATOR. The switch or circuit-breaker shall be marked as the disconnecting device for the controller.

CAUTION **Applying the wrong power to the controller will severely damage the controller and is a fire and smoke hazard.**

Figure 2-5 shows the wiring connections for line voltage.

Figure 2-5 Line Voltage Wiring



① The Process controller and the enclosure in which it is mounted shall be grounded in accordance with National and Local electrical codes. Provide a switch and a slow-blow (North American), quick-acting, high breaking capacity, type F, (Europe) 2A fuse(s) for 24V (ac or dc) operation, and a 1/2 A, 250V fuse(s), or circuit breaker for 120/240 Vac operation, as part of this installation.

② If power service has grounded neutral, connect lead "A" to neutral and omit the fuse in the neutral lead.

③ PROTECTIVE BONDING (grounding) of this controller and the enclosure in which it is installed shall be in accordance with National and local electrical codes. To minimize electrical noise and transients that may adversely affect the system, supplementary bonding of the controller enclosure to a local ground, using a No. 12 (4 mm2) copper conductor, is recommended.

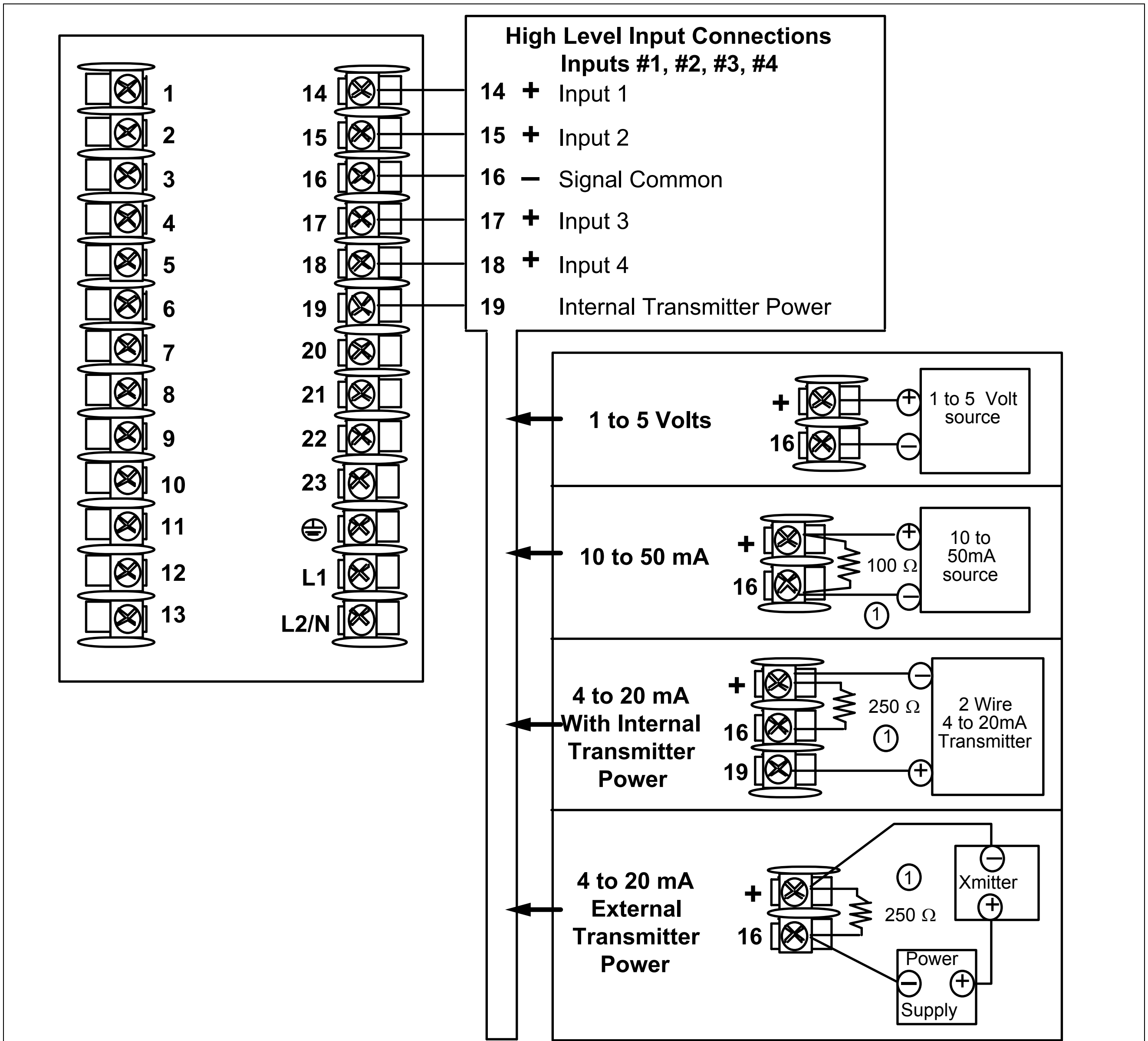
④ Before applying power to the controller, set the power select jumpers on the MCU/Input PWB for the correct operating voltage.

Continued on next page

High level input connections

Figure 2-6 shows the wiring connections for Input #1, #2, #3, and #4, also Internal Transmitter Power.

Figure 2-6 High Level Input Connections



① The 250Ω load resistor for the 4-20mA range or the 100Ω load resistor for the 10-50mA range is supplied with the controller when the input is specified.

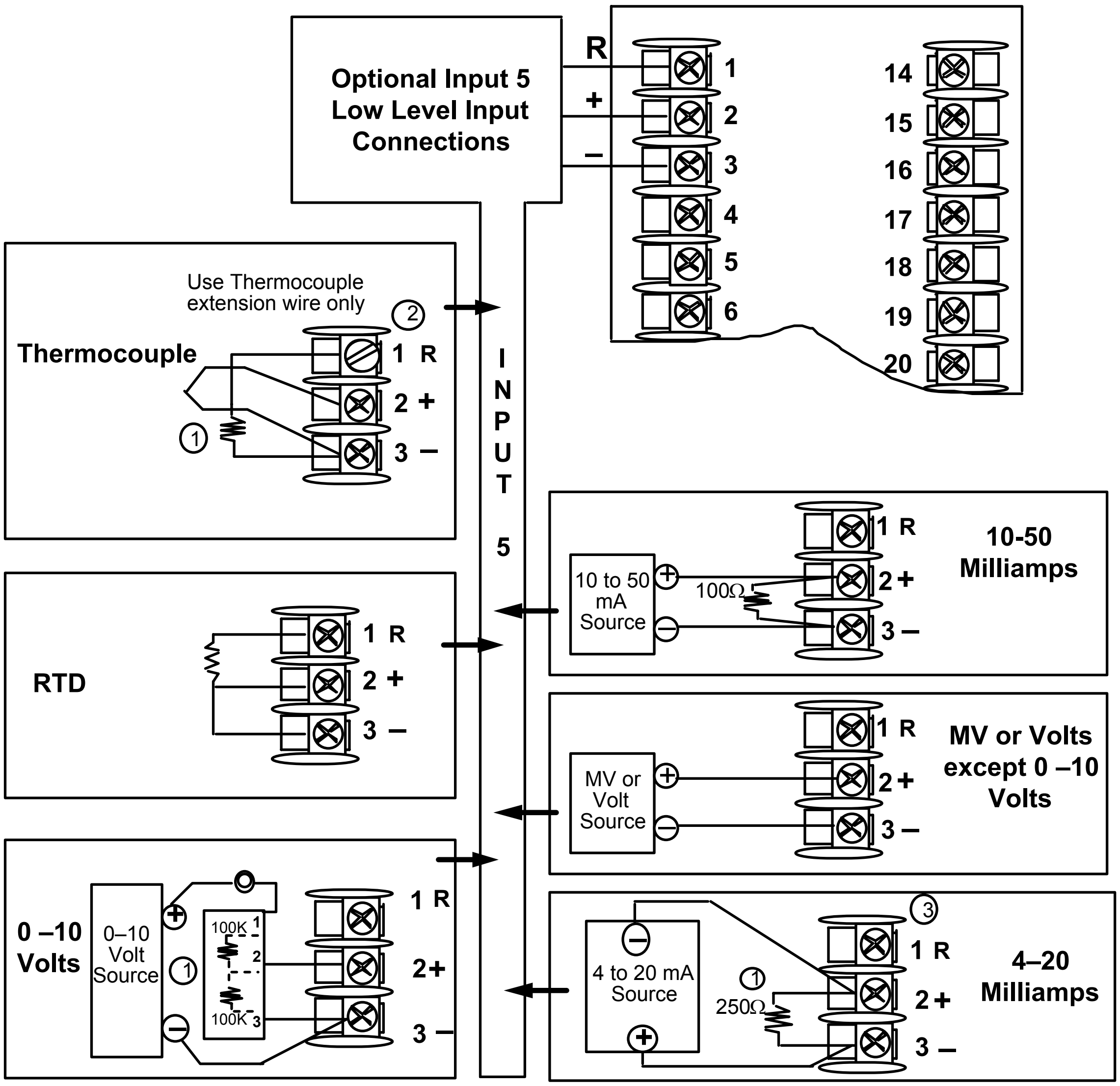
ATTENTION These items must be installed when you wire the controller before startup.

Continued on next page

Optional Input 5 (Low Level Inputs)

Figure 2-7 shows the wiring connections for Optional Input 5, Low Level Input.

Figure 2-7 Optional Input 5, Low level Input Connections



1 The 250Ω load resistor for 4-20mA range, the 100Ω load resistor for the 10-50 mA range, the Voltage divider for 0–10 Volts, or the 500 ohm C/J compensation resistor are supplied with the controller when the input is specified. These items must be installed when you wire the controller before startup.

2 When installing the cold junction for a T/C input, remove the screw from terminal 1 and install the threaded end of the assembly into its place.

3 Transmitter Power is not available with this option.

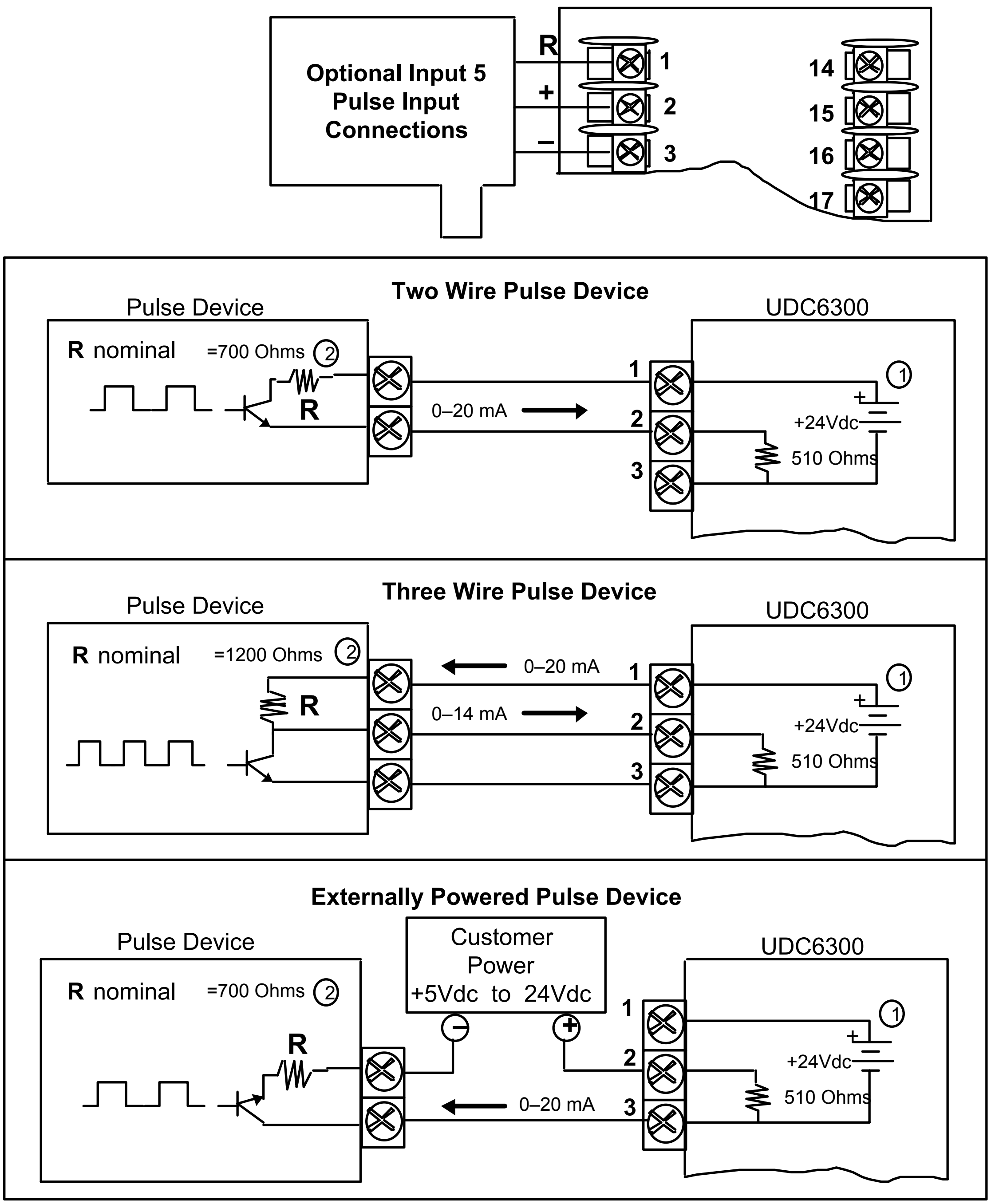
21752

Continued on next page

Optional Input 5 (Pulse Inputs)

Figure 2-8 shows the wiring connections for Optional Input 5-Pulse Inputs.

Figure 2-8 Optional Input 5-Pulse Input Connections



1 Dedicated Transmitter Power supply for Pulse Input Devices only.

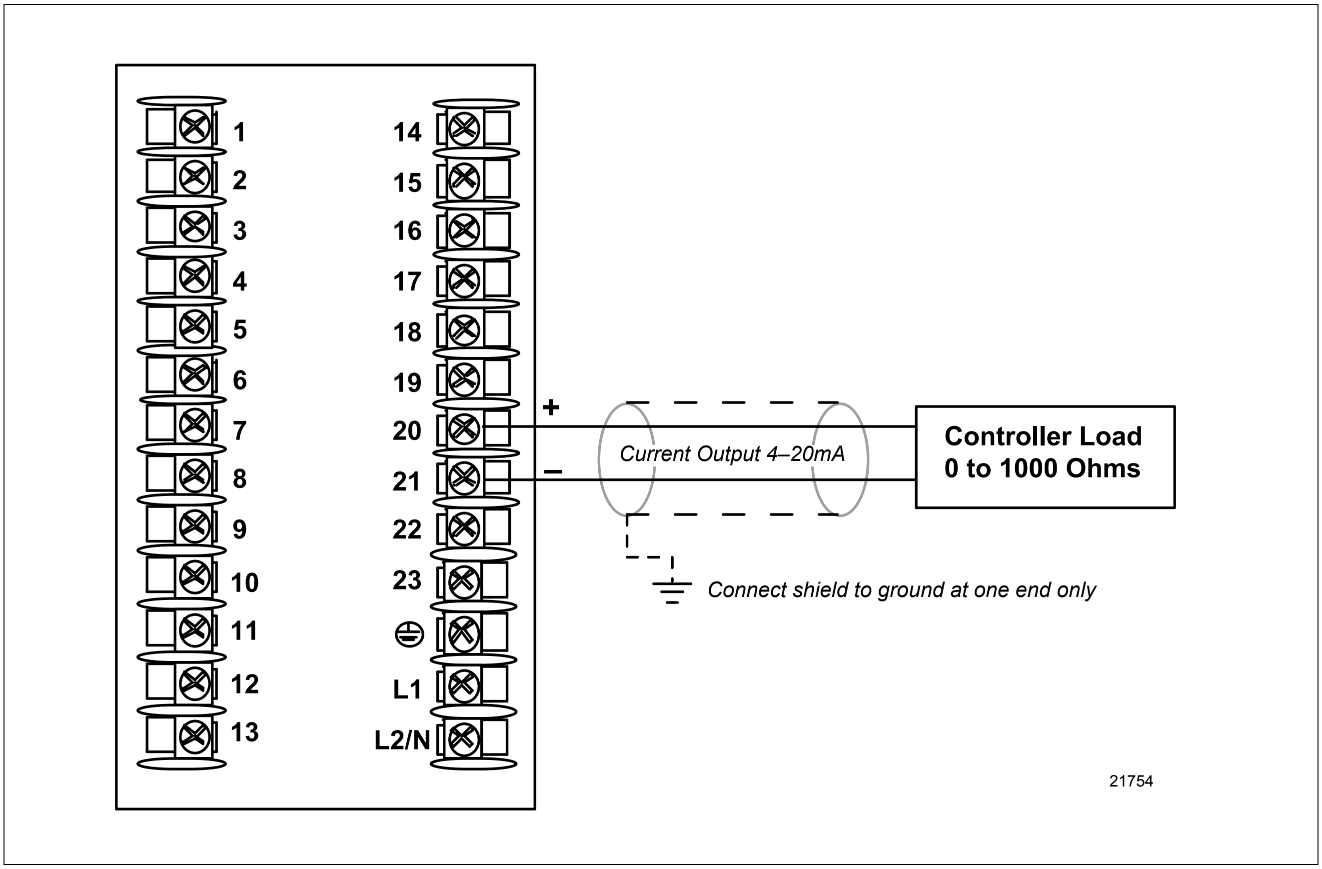
2 Resistor is supplied by user if required

Continued on next page

Current Output

Figure 2-9 shows the wiring connections for Current Output.

Figure 2-9 Current Output Connections

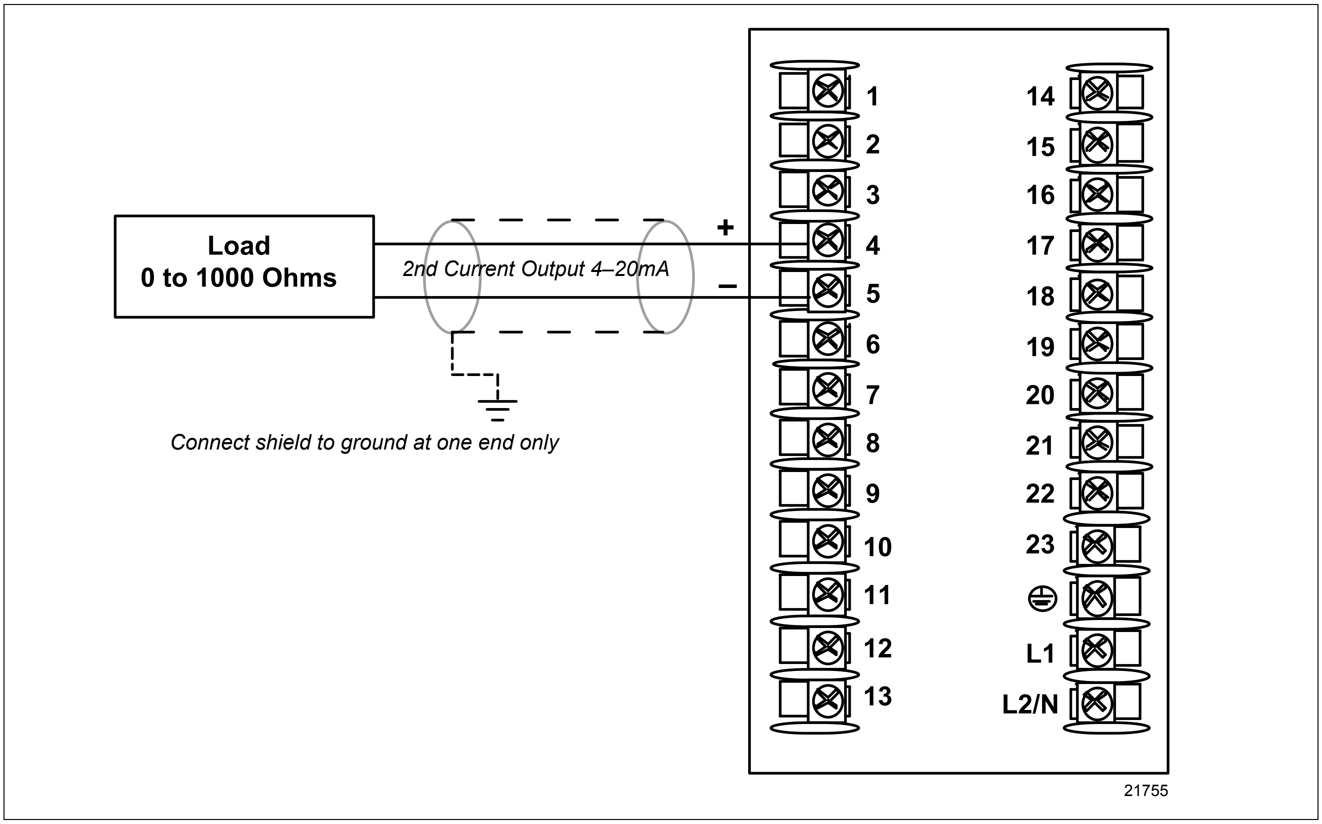


Continued on next page

Second Current Output

Figure 2-10 shows the wiring connections for a Second Current Output.

Figure 2-10 Second Current Output Connections

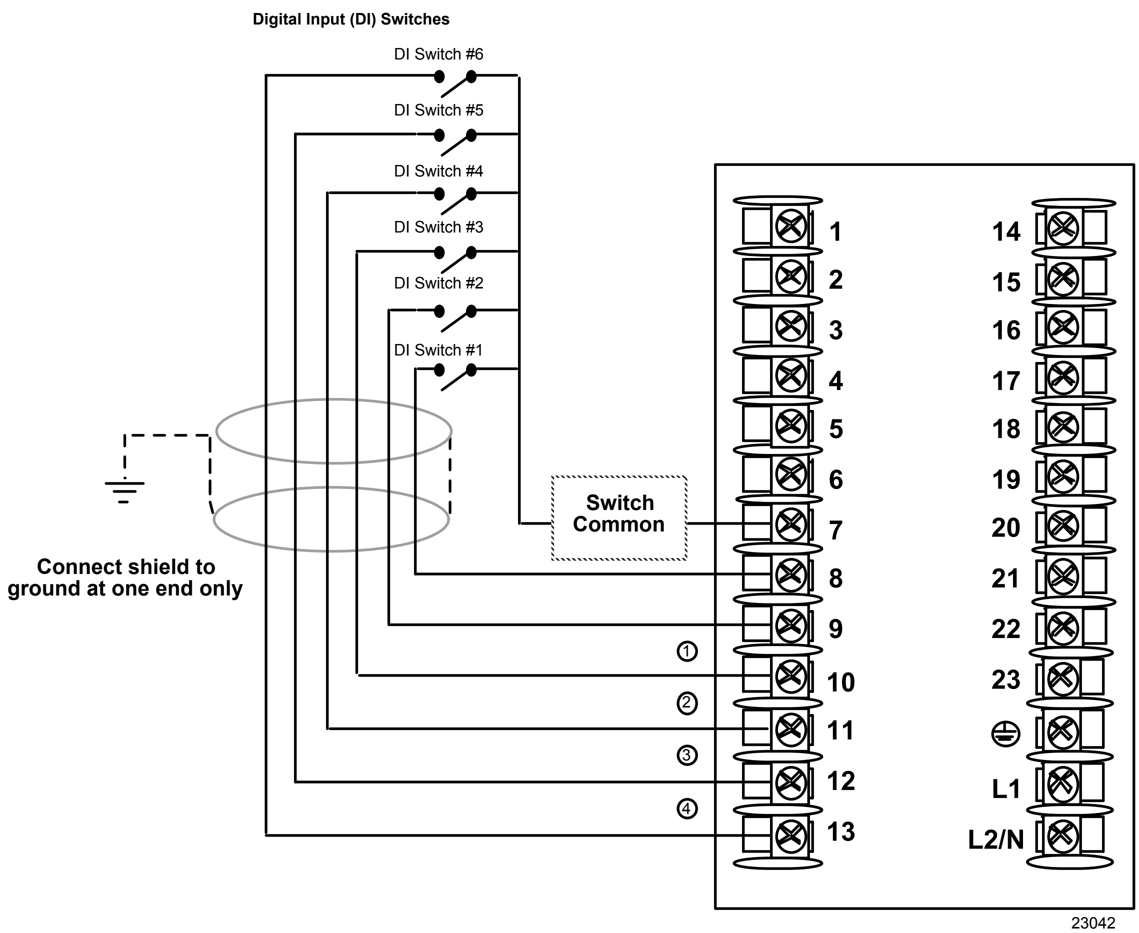


Continued on next page

Digital Inputs

Figure 2-11 shows the wiring connections for all six Digital Inputs.

Figure 2-11 Digital Input Connections



① Digital Input #3 shares rear terminals with Digital Output #1 - Alarm #1. Any use of this output will trigger this digital Input.

② Digital Input #4 shares rear terminals with Digital Output #2 - Alarm #2. Any use of this output will trigger this digital Input.

③ Digital Input #5 shares rear terminals with Digital Output #3 - Alarm #3 or Control Output #1. Any use of this output will trigger this digital Input.

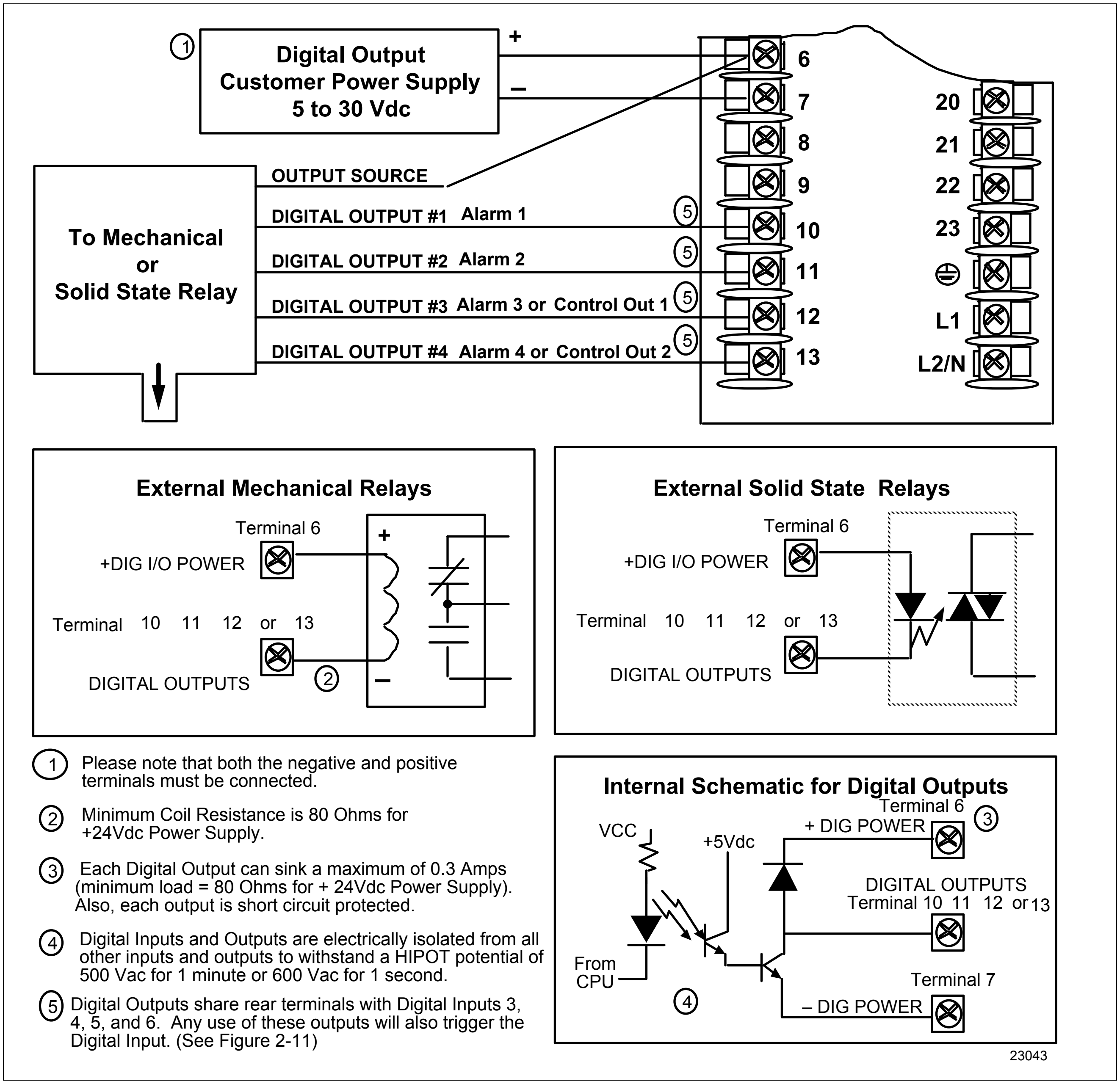
④ Digital Input #6 shares rear terminals with Digital Output #4 - Alarm #4 or Control Output #2. Any use of this output will trigger this digital Input.

Continued on next page

Digital Outputs

Figure 2-12 shows the wiring connections for Digital Outputs.

Figure 2-12 Digital Output Connections

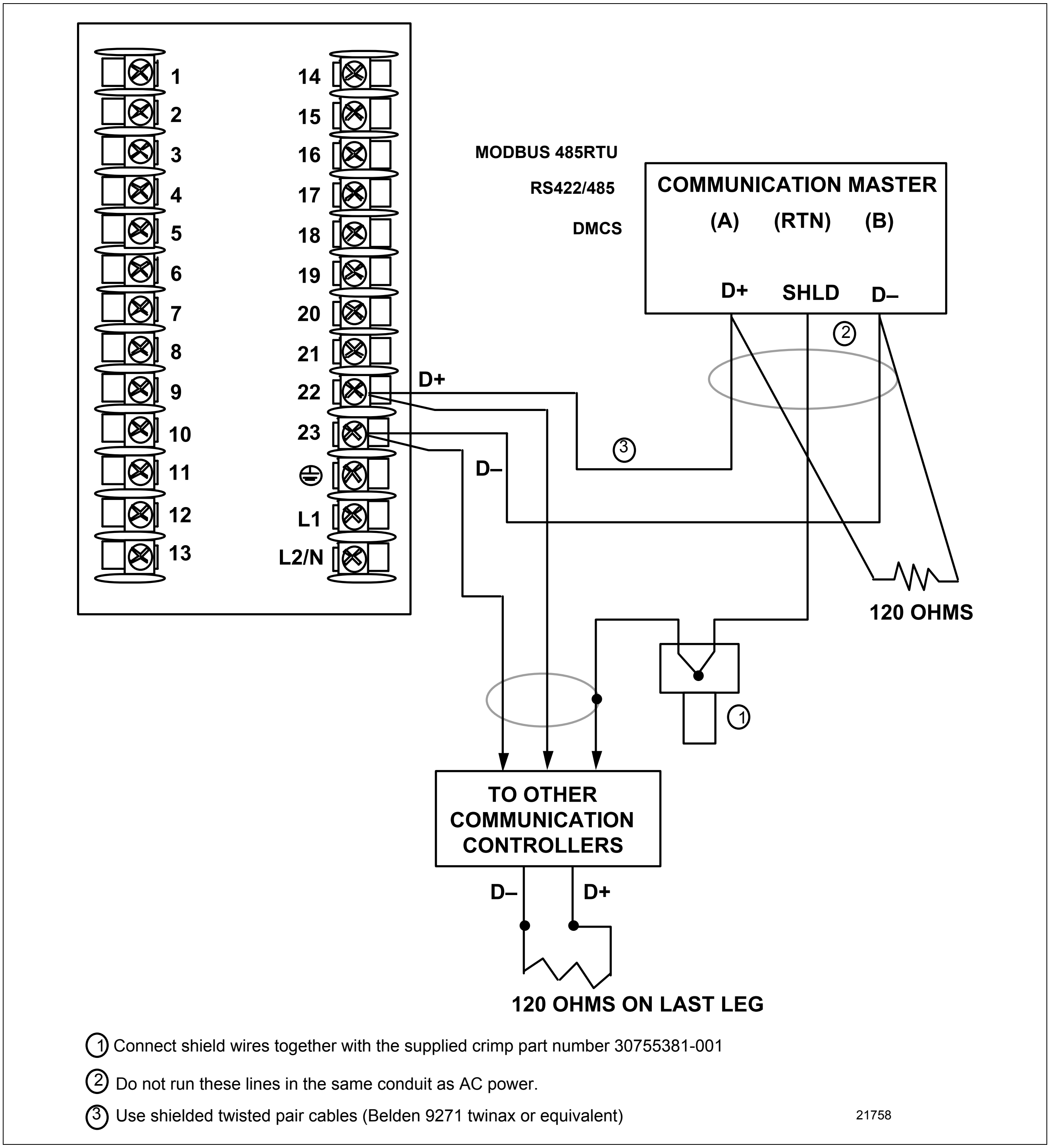


Continued on next page

Communications option connections

There are several types of Communications option available:
- RS422ASCII - also refer to Document # 51-51-25-35
- DMCS - also refer to Document # 82-50-10-26
- RS485RTU - also refer to Document # 51-52-25-53
- RS485TDC - also refer to Document # PM12-520

Figure 2-13 Communications Option Connections



Section 3 – Configuration

3.1 Overview

Introduction

Configuration is a dedicated operation where you use straightforward keystroke sequences to select and establish (configure) pertinent control data best suited for your application.

What's in this section?

The table below lists the topics that are covered in this section.

Topic		Page
3.1	Overview	27
3.2	Configuration Prompts	28
3.3	How to Get Started	30
3.4	Configuration Tips	31
3.5	Configuration Procedure	32
3.6	Tuning Parameters Setup Group	34
3.7	Tuning L2 Parameters Setup Group	37
3.8	Setpoint Ramp/Program Setup Group	39
3.9	Accutune Setup Group	40
3.10	Algorithm Data Setup Group	42
3.11	Advanced Math Setup Group	48
3.12	Output Algorithm Setup Group	51
3.13	Input 1 through 4 Parameters Setup Group	52
3.14	Input 5 Parameters Setup Group	53
3.15	Loop 1 Control Parameters Setup Group	54
3.16	Loop 2 Control Parameters Setup Group	56
3.17	Options Parameters Setup Group	58
3.18	Communications Parameters Setup Group	60
3.19	Alarms Parameters Setup Group	62
3.20	Display Parameters Setup Group	65
3.21	Calib Group	66
3.22	Status Group	66
3.23	Configuration Record Sheet	67

Prompts

To assist you in the configuration process, there are prompts that appear in the upper and lower displays. These prompts let you know what group of configuration data (Set Up prompts) you are working with and also, the specific parameters (Function prompts) associated with each group.

Figure 3-1 shows you an overview of the prompt hierarchy.
As you will see, the configuration data is divided into 18 main Set Up groups plus prompts for calibration and prompts that show the status of the continuous background tests that are being performed.

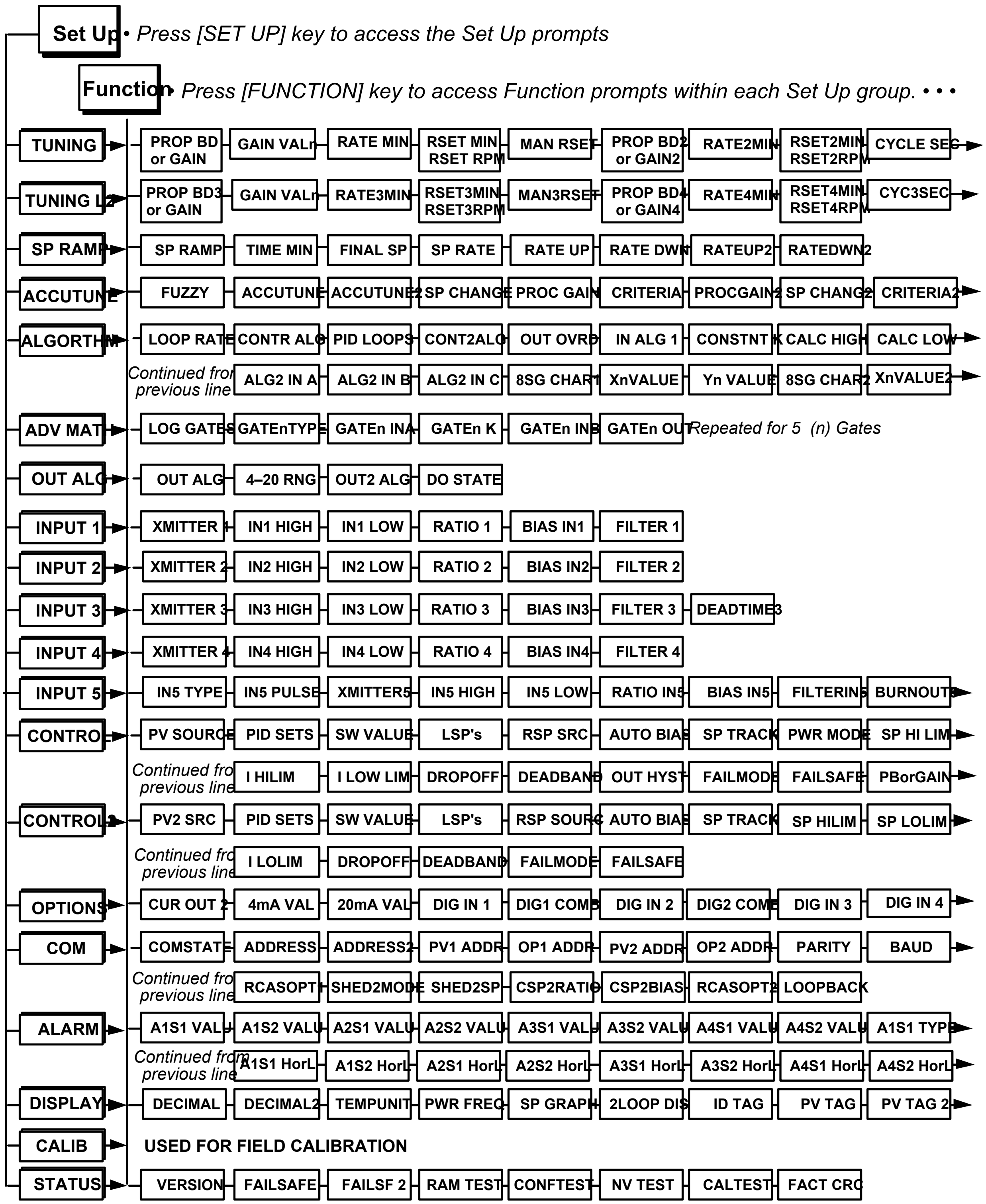
Continued on next page

3.2 Configuration Prompts

Diagram: prompt hierarchy

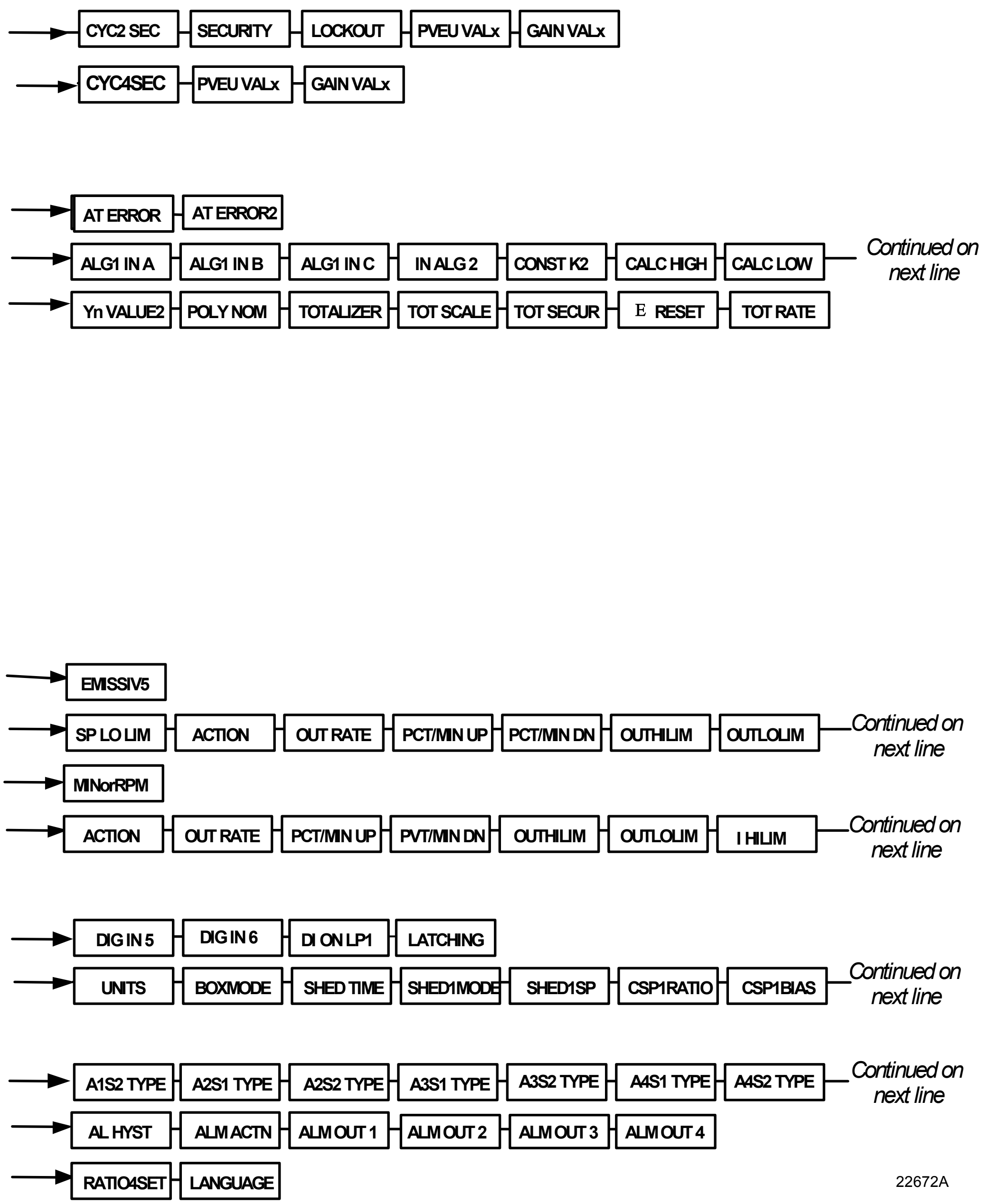
Figure 3-1 shows an overview of the UDC 6300 Set Up prompts and their associated Function prompts. (Read from left to right.)

Figure 3-1 Overview of UDC6300 Prompt Hierarchy



Continued on next page

...Press ▲ or ▼ to change the value or selection of the Function prompt.



3.3 How To Get Started

Read the configuration tips

Read "*Configuration Tips*" shown on the next page. These tips will help you to easily and quickly accomplish the tasks at which you will be working when you configure your controller.

Read configuration procedure

Read "*Configuration Procedure*". This procedure tells you how to access the Set Up groups, and the Function parameters within each of these groups that are shown in the Prompt Hierarchy in Figure 3-1.

Set Up groups

The Set Up groups and Function parameters are listed in the order of their appearance. The list includes the name of the prompt, the range of setting or selections available, and the factory setting.

Parameter explanations or definitions

This section is for those who only need a reference to a particular Set up group or function prompt selection.

If you need a detailed explanation of any prompt listed, refer to
Section 4 – Configuration Parameter Definitions.
This section lists the Set Up and Function prompts, the selections or range of settings that you can make for each, plus a detailed explanation or definition of each parameter and their dependencies and limitations.

Configuration record sheet

Located on the last page of this section is a "*Configuration Record Sheet*". When you make your configuration selections, record them on this sheet. Then you will have a record of how the controller was configured.

3.4 Configuration Tips

Introduction

Listed below in Table 3-1 are a few tips that will help you enter the configuration data more quickly.

ATTENTION If you are replacing a UDC6000 or an existing UDC6300 you can keep the old configuration data by removing the EEPROM from the old unit and placing it in the new unit. Refer to Subsection 8.8 for location of the EEPROM and instructions.

Table 3-1 Configuration Tips

Function	Tip
Displaying Groups	Use the SET UP key to display the Set Up groups. The group titles are listed in this section in the order that they appear in the controller.
Displaying Functions	Use the FUNC key to display the individual parameters under each group. The prompts are listed in the order of their appearance in each group.
Scrolling	When in the Set Up mode, use the ▲ or ▼ key to scan the Set Up groups in both directions. Groups scroll at a rate of 3 per second.
Changing values quickly	When changing the value of a parameter, you can use a single ▲ or ▼ key. Hold the key in to increase the rate of change. Stop pressing the key for 1/2 second , then press again to restart at a slow rate. You can also adjust a more significant digit in the upper display by holding in one key ▲ or ▼ and pressing the other ▲ or ▼ at the same time. The adjustment will move one digit to the left. Press the key again and you will move one more digit to the left.
Restoring to the original value	When you change the value or selection of a parameter while in Set Up mode and decide not to enter it, press FUNC and ▲ simultaneously, the original value or selection will be recalled.
Exiting SET UP mode	To exit Set Up mode, press the LOWR DISP key. This returns the display to the same state it was in immediately preceding entry into the Set Up mode.
Timing out from Set Up mode	If you are in Set Up mode and do not press any keys for one minute, the controller will time out and revert to the mode and display that was being used prior to entry into Set Up mode and stores any changes you have made.
Key Error	When a key is pressed and the prompt “KEY ERROR” appears in the lower display, it will be for one of the following reasons: • parameter not available • not in Set Up mode, press SET UP key first • key malfunction, do keyboard test (operation) • Individual key locked out

3.5 Configuration Procedure

Introduction

Each of the Set Up groups and their functions are pre-configured at the factory.
The factory settings are shown in the Set Up group tables that follow this procedure.
If you want to change any of these selections or values, follow the procedure in Table 3-2. This procedure tells you the keys to press to get to any Set Up group and any associated Function parameter prompt.
If you need a detailed explanation of any prompt, refer to *Section 4 – Configuration Parameter Definitions*.

Procedure

Follow the procedure listed in Table 3-2 to access the Set Up groups and Function prompts.

Table 3-2 Configuration Procedure

Step	Operation	Press	Result
1	Select Set Up mode	SET UP	Upper Display: SET UP — Lets you know you are in the configuration mode and a Set Up group title is being displayed in the lower display. Lower Display: TUNING — This is the first Set Up group title.
2	Select any Set Up group	SET UP	Successive presses of the SET UP key will sequentially display the other Set Up group titles shown in the prompt hierarchy in figure 3-1. You can also use the ▲ or ▼ keys to scan the Set Up groups in both directions. Stop at the Set Up group title which describes the group of parameters you want to configure. Then proceed to the next step.
3	Select a Function Parameter	FUNC L1/L2	Upper Display: 1.0 — Shows you the current value or selection for the first function prompt of the particular Set Up group that you have selected. Lower Display: GAIN — Shows the first Function prompt within that Set Up group. Example displays show Set Up group “Tuning”, Function prompt “Gain” and the value selected.

Table 3-2 continued on next page

Procedure (continued)

Table 3-2 Configuration Procedure, continued

Step	Operation	Press	Result
4	Select other Function Parameters	FUNC L1/L2	Successive presses of the FUNC Key will sequentially display the other function prompts of the Set Up group you have selected. Stop at the function prompt that you want to change, then proceed to the next step.
5	Change the value or selection	▲ or ▼	These keys will increment or decrement the value or selection that appears for the function prompt you have selected. See "Configuration Tips" for instructions to increase or decrease value quickly. Change the value or selection to meet your needs. If the display flashes, you are trying to make an unacceptable entry. **ATTENTION** When you change the value or selection of a parameter while in Set Up mode and decide not to enter it, press FUNC and ▲ simultaneously, the original value or selection will be recalled.
6	Enter the value or selection	FUNC L1/L2 or SET UP	This key selects another function prompt. This key selects another Set Up group. The value or selection you have made will be entered into memory after another key is pressed.
7	Exit Configuration	LOWR DISP	This exits configuration mode and returns the controller to the same state it was in immediately preceding entry into the Set Up mode. It stores any changes you have made.

3.6 Tuning Parameters Set Up Group

Introduction

The Tuning Set Up group contains the Function parameters that will allow your controller to respond correctly to changes in process variable or setpoint.

You can start with predetermined values but you will have to watch your process to determine how to modify them.

If you have the Adaptive Tune option, this will automatically select Gain, Rate, and Reset values.

Set this group last

Because this group contains functions that have to do with Security and Lockout, it is best to configure this group last, after all the other configuration data has been loaded.

Duplex Heat Cool

See Table 4-2 in *Section 4 - Prompt Definitions* for Duplex Heat/Cool designations.

Continued on next page

Function prompts

Table 3-3 lists all the function prompts in the Tuning Set Up group. How the "Algorithm" and "Control" Set Up groups are configured determines which prompts will appear.

Table 3-3 Tuning Group Function Prompts

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
PROP BAND or **GAIN**	Proportional Band, or Gain	0.1 to 9999 (PB) 0.001 to 1000 (Gain)	- - 1.0
GAIN VALn	Gain Value being used by **Gain Scheduling** when enabled	Read Only	- -
RATE MIN	Rate in Minutes	0.00 to 10.00 minutes (0.00=Off)	0.00
RESET MIN **RESET RPM**	Reset in minutes/repeat Reset in repeats/minute	0.02 to 50.00 0.02 to 50.00	1.0 1.0
MAN RESET	Manual Reset	–100 to 100% Output	0.0
PROPBAND2 or **GAIN 2**	Proportional Band 2, or Gain 2	0.1 to 9999 (PB) 0.001 to 1000 (Gain)	- - 1.0
RATE2MIN	Rate 2 in Minutes	0.00 to 10.00 minutes (0.00=Off)	0.00
RESET2MIN **RESET2RPM**	Reset 2 in minutes/repeat Reset 2 in repeats/minute	0.02 to 50.00 0.02 to 50.00	1.0 - -
CYCLE SEC	Cycle Time (Heat)	1 to 120 seconds	4
CYC2 SEC	Cycle Time 2 (Cool)	1 to 120 seconds	4
SECURITY	Security Code	0 to 4095	0
LOCKOUT	Configuration Lockout	NONE CALIBRATE +CONF +VIEWING MAXIMUM	CALIB
PVEU VAL1	PV1 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL2	PV2 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL3	PV3 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL4	PV4 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0

Table 3-3 continued on next page

Function prompts (continued)

Table 3-3 Tuning Group Function Prompts, continued

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
PVEU VAL5	PV5 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL6	PV6 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL7	PV7 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL8	PV8 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
GAIN VAL1 *	Gain 1 Value for Gain Scheduling	0.001 to 1000 Gain or PB	1.0
GAIN VAL2 *	Gain 2 Value for Gain Scheduling	0.001 to 1000 Gain or PB	1.0
GAIN VAL3 *	Gain 3 Value for Gain Scheduling	0.001 to 1000 Gain or PB	1.0
GAIN VAL4 *	Gain 4 Value for Gain Scheduling	0.001 to 1000 Gain or PB	1.0
GAIN VAL5 *	Gain 5 Value for Gain Scheduling	0.001 to 1000 Gain or PB	1.0
GAIN VAL6 *	Gain 6 Value for Gain Scheduling	0.001 to 1000 Gain or PB	1.0
GAIN VAL7 *	Gain 7 Value for Gain Scheduling	0.001 to 1000 Gain or PB	1.0
GAIN VAL8 *	Gain 8 Value for Gain Scheduling	0.001 to 1000 Gain or PB	1.0

* **ATTENTION** If units of percent proportional band (PB) are selected under Set Up prompt "CONTROL", function prompt "PB or GAIN, these values displayed are in %PB, but the lower display will still show Gain.

3.7 Tuning L2 Parameters Set Up Group (Cascade or 2 Loop)

Function prompts

Table 3-4 lists all the function prompts in the Tuning L2 Set Up group. This group is only displayed if the controller is configured for "Cascade" or
"2 Loop" control at prompt "PV2SCR"

Table 3-4 Tuning L2 Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
PROPBAND3 or **GAIN3**	Proportional Band 3, or Gain 3	0.1 to 9999 (PB) 0.001 to 1000 (Gain)	- - 1.0
GAIN VALn	Gain Value being used by Gain Scheduling when enabled	Read Only	- -
RATE 3 MIN	Rate 3 in Minutes	0.00 to 10.00 minutes (0.00=Off)	0.00
RESET3MIN **RESET3RPM**	Reset 3 in minutes/repeat Reset 3 in repeats/minute	0.02 to 50.00 0.02 to 50.00	1.0 - -
MAN RESET3	Manual Reset 3	–100 to 100% Output	0.0
PROPBAND4 or **GAIN 4**	Proportional Band 4, or Gain 4	0.1 to 9999 (PB) 0.001 to 1000 (Gain)	- - 1.0
RATE4MIN	Rate 4 in Minutes	0.00 to 10.00 minutes (0.00=Off)	0.00
RESET4MIN **RESET4RPM**	Reset 4 in minutes/repeat Reset 4 in repeats/minute	0.02 to 50.00 0.02 to 50.00	1.0 - -
CYC 3SEC	Cycle Time 3 (Heat)	1 to 120 seconds	4
CYC4 SEC	Cycle Time 4 (Cool)	1 to 120 seconds	4
PVEU VAL1	PV1 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL2	PV2 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL3	PV3 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL4	PV4 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL5	PV5 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL6	PV6 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0

Table 3-4 continued on next page

Function prompts (continued)

Table 3-4 Tuning Group Function Prompts, continued

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
PVEU VAL7	PV7 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
PVEU VAL8	PV8 Value for Gain Scheduling	PV value within the PV limits. In Engineering units	0
GAIN VAL1 *	Gain 1 Value for Gain Scheduling	0.001 to 1000	1.0
GAIN VAL2 *	Gain 2 Value for Gain Scheduling	0.001 to 1000	1.0
GAIN VAL3 *	Gain 3 Value for Gain Scheduling	0.001 to 1000	1.0
GAIN VAL4 *	Gain 4 Value for Gain Scheduling	0.001 to 1000	1.0
GAIN VAL5 *	Gain 5 Value for Gain Scheduling	0.001 to 1000	1.0
GAIN VAL6 *	Gain 6 Value for Gain Scheduling	0.001 to 1000	1.0
GAIN VAL7 *	Gain 7 Value for Gain Scheduling	0.001 to 1000	1.0
GAIN VAL8 *	Gain 8 Value for Gain Scheduling	0.001 to 1000	1.0

* **ATTENTION** If units of percent proportional band (PB) are selected under Set Up prompt "CONTROL", function prompt "PB or GAIN, these values displayed are in %PB, but the lower display will still show Gain.

3.8 SP Ramp/Program Set Up Group

Single Setpoint Ramp

The Setpoint Ramp Set Up group contains the Function parameters that let you configure a single set point ramp to occur between the current local setpoint and a final setpoint over a time interval (SP RAMP).

Setpoint rate

The Setpoint Ramp Set Up group also contains the function parameters that let you configure a specific rate of change for any Local Setpoint change (SP RATE). It includes selections for Rate Up and Rate Down.

Function prompts

Table 3-5 lists all the function prompts in the SP RAMP Set Up group.

Table 3-5 SP Ramp Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
SP RAMP	Single Setpoint Ramp Selection	DISABLE ENABLE ENABLE 2 ENABLE 12	DISABLE
TIME MIN	Single Setpoint Ramp Time	0 to 255 minutes	3
FINAL SP	Single Setpoint Final Setpoint	Enter a value within the setpoint limits	1000
SP RATE	Setpoint Rate	DISABLE ENABLE ENABLE 2 ENABLE 12	DISABLE
EU/HR UP	Rate Up Value for Loop 1 (SP Rate Enabled)	0 to 9999 in Units per Hour	0
EU/HR DN	Rate Down Value for Loop 1 (SP Rate Enabled)	0 to 9999 in Units per Hour	0
EU/HR UP2	Rate Up Value for Loop 2 (SP Rate Enabled)	0 to 9999 in Units per Hour	0
EU/HR DN2	Rate Down Value for Loop 2 (SP Rate Enabled)	0 to 9999 in Units per Hour	0

3.9 Accutune Set Up Group

Introduction

The Accutune Set Up group offers these selections:

• (FUZZY) **Fuzzy Overshoot Suppression** - uses fuzzy logic to suppress or eliminate any overshoot that may occur when the PV approaches setpoint.

• (TUNE) **Demand Tuning** - The tuning process is initiated through the operator interface keys or via a digital input (if configured). The algorithm then calculates new tuning parameters and enters them in the tuning group.

• (SP Only) **SP Tuning** -SP Tune continuously adjusts the PID parameters in response to setpoint changes. You can select tuning on minimum setpoint changes of 5% up to 15% span. Perform SP tuning after you have configured the controller.
SP Tuning does not work with 3 Position Step Control algorithm.

• (TUNE + PV) or (SP + PV) **PV Tuning** - The (TUNE) Demand Tuning or the (SP Only) Setpoint Tuning portions of these selections work as stated above. **PV Adapt** will occur during Process Variable (PV) disturbances (0.3% span or larger) which result from non-linearities, process dynamics, load changes, or other operating conditions. When this condition exists, the controller monitors the process response for 1 and 1/2 process cycles around the setpoint to determine whether there has been a true process change or a momentary upset.

Continued on next page

Function prompts Table 3-6 lists the function prompts in the "ACCUTUNE" Set Up group.

Table 3-6 Accutune Group Function Prompts

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
FUZZY	Fuzzy Overshoot Suppression	DISABLE ENABLE	Disabl
ACCUTUNE	Accutune	DISABLE TUNE (Demand Tuning) SP ONLY (SP Tuning) TUNE + PV SP ONLY+ PV	Disabl
ACCUTUNE2	Accutune2	DISABLE TUNE (Demand Tuning) SP ONLY (SP Tuning) TUNE + PV SP ONLY + PV	Disabl
SP CHANG*	Setpoint Change Value	5 to 15% Input Span	10
PROC GAIN*	Process Gain	0.10 to 10.00	1.0
SP CHANG2*	Setpoint Change Value	5 to 15% Input Span	10
PROCGAIN2*	Process Gain	0.10 to 10.00	1.0
CRITERIA*	Tuning Criteria - Loop 1	NORMAL FAST	FAST
CRITERIA2*	Tuning Criteria - Loop 2	NORMAL FAST	FAST
AT ERROR **or** **AT ERROR 2** (depending on Loop)	AccutuneError codes	Read Only NONE OUT LIMIT ID FAIL ABORT LOW PV RUNNING	- -

*** APPLIES TO "SP ONLY" AND "SP + PV) ONLY**

3.10 Algorithm Data Set Up Group

Introduction

This data deals with various algorithms residing in the controller: Control Algorithms, Input Math algorithms, Selecting the Number of PID Loops, and Output Override.

Function prompts

Table 3-7 lists all the function prompts in the "ALGORITHM" Set Up group.

Table 3-7 Algorithm Group Function Prompts

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
LOOP RATE	Loop Sampling Rate (conversions per second) for loop 1 and loop 2.	**LOOP 1** **LOOP 2** 1 12X 1 9X 2 0X 1 6X 2 3X 1 3X 2 3X •*Input 5 cannot be used for this selection.*	1 3X 2 3X
CONT ALG	Control Algorithm	ON-OFF PID A PID B PD+MR 3POS STEP M/A STN	PID A
MTR TIME	Three position Step Motor Time (appears only if 3POS STEP is selected at prompt "CONT ALG".)		
PID LOOPS	PID Loop Selection	1 LOOP 2 LOOPS CASCADE	1 or 2
CONT2 ALG	Control 2 Algorithm	PID A PID B PD+MR M/A STN	PID A
OUT OVRD	Output Override Select	DISABLE HI SELECT LO SELECT	DISABLE
IN ALG1	Input 1 Algorithm (formulas are located in Section 4)	NONE WTD AVG FFWD SUM SUMMER HI SELECT LO SELECT √ MUL DIV √ MULTIPLY MULT DIV MULTIPLY FFWD MUL	NONE
CONST K	Weighted Average Ratio or K Constant for Math Selections	0.001 to 1000	- -

Table 3-7 continued on next page

Function prompts (continued)

Table 3-7 Algorithm Group Function Prompts, continued

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
CALC HIGH	Calculated Variable High Scaling Factor for Input Algorithm 1	–999.0 to 9999 in Engineering Units	- -
CALC LOW	Calculated Variable Low Scaling Factor for Input Algorithm 1	–999.0 to 9999 in Engineering Units	- -
ALG1 IN A	Input Algorithm 1 Input A Selection	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG OUTPUT 1 OUTPUT 2	- -
ALG1 IN B	Input Algorithm 1 Input B Selection	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG OUTPUT 1 OUTPUT 2	- -
ALG1 IN C	Input Algorithm 1 Input C Selection	NONE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG	- -
IN ALG2	Input 2 Algorithm (formulas are located in Section 4)	NONE WTD AVG FFWD SUM 2 A–B DIV C HI SELECT LO SELECT √ MUL DIV √ MULTIPLY MULT DIV MULTIPLY FFWD MUL 2	NONE
CONST K2	Weighted Average Ratio or K Constant for Math Selections	0.001 to 1000	- -

Table 3-7 continued on next page

Function prompts (continued)

Table 3-7 Algorithm Group Function Prompts, continued

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
CALC HIGH	Calculated Variable High Scaling Factor for Input Algorithm 2	–999.0 to 9999 in Engineering Units	- -
CALC LOW	Calculated Variable Low Scaling Factor for Input Algorithm 2	–999.0 to 9999 in Engineering Units	- -
ALG2 IN A	Input Algorithm 2 Input A Selection	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG OUTPUT 1 OUTPUT 2	- -
ALG2 IN B	Input Algorithm 2 Input B Selection	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG OUTPUT 1 OUTPUT 2	- -
ALG2 IN C	Input Algorithm 2 Input C Selection	NONE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG	- -

Table 3-7 continued on next page

Function prompts (continued)

Table 3-7 Algorithm Group Function Prompts, continued

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
8SG CHAR1	Eight Segment Characterizer	DISABLE INPUT 2 LOOP 1 OUT LOOP 2 OUT INPUT 4	DISABLE
X0 VALUE	X0 Input Value (X Axis)	0 to 99.99 %	0
X1 VALUE	X1 Input Value (X Axis)	0 to 99.99 %	0
X2 VALUE	X2 Input Value (X Axis)	0 to 99.99 %	0
X3 VALUE	X3 Input Value (X Axis)	0 to 99.99 %	0
X4 VALUE	X4 Input Value (X Axis)	0 to 99.99 %	0
X5 VALUE	X5 Input Value (X Axis)	0 to 99.99 %	0
X6 VALUE	X6 Input Value (X Axis)	0 to 99.99 %	0
X7 VALUE	X7 Input Value (X Axis)	0 to 99.99 %	0
X8 VALUE	X8 Input Value (X Axis)	0 to 99.99 %	0
Y0 VALUE	Y0 Output Value (Y Axis)	0 to 99.99 %	0
Y1 VALUE	Y1 Output Value (Y Axis)	0 to 99.99 %	0
Y2 VALUE	Y2 Output Value (Y Axis)	0 to 99.99 %	0
Y3 VALUE	Y3 Output Value (Y Axis)	0 to 99.99 %	0
Y4 VALUE	Y4 Output Value (Y Axis)	0 to 99.99 %	0
Y5 VALUE	Y5 Output Value (Y Axis)	0 to 99.99 %	0
Y6 VALUE	Y6 Output Value (Y Axis)	0 to 99.99 %	0
Y7 VALUE	Y7 Output Value (Y Axis)	0 to 99.99 %	0
Y8 VALUE	Y8 Output Value (Y Axis)	0 to 99.99 %	0

Table 3-7 continued on next page

Function prompts (continued)

Table 3-7 Algorithm Group Function Prompts, continued

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
8SG CHAr2	Eight Segment Characterizer 2	DISABLE INPUT 2 LOOP 1 OUT LOOP 2 OUT INPUT 4	DISABLE
X0 VALUE2	X0 Input Value (X Axis)	0 to 99.99 %	0
X1 VALUE2	X1 Input Value (X Axis)	0 to 99.99 %	0
X2 VALUE2	X2 Input Value (X Axis)	0 to 99.99 %	0
X3 VALUE2	X3 Input Value (X Axis)	0 to 99.99 %	0
X4 VALUE2	X4 Input Value (X Axis)	0 to 99.99 %	0
X5 VALUE2	X5 Input Value (X Axis)	0 to 99.99 %	0
X6 VALUE2	X6 Input Value (X Axis)	0 to 99.99 %	0
X7 VALUE2	X7 Input Value (X Axis)	0 to 99.99 %	0
X8 VALUE2	X8 Input Value (X Axis)	0 to 99.99 %	0
Y0 VALUE2	Y0 Output Value (Y Axis)	0 to 99.99 %	0
Y1 VALUE2	Y1 Output Value (Y Axis)	0 to 99.99 %	0
Y2 VALUE2	Y2 Output Value (Y Axis)	0 to 99.99 %	0
Y3 VALUE2	Y3 Output Value (Y Axis)	0 to 99.99 %	0
Y4 VALUE2	Y4 Output Value (Y Axis)	0 to 99.99 %	0
Y5 VALUE2	Y5 Output Value (Y Axis)	0 to 99.99 %	0
Y6 VALUE2	Y6 Output Value (Y Axis)	0 to 99.99 %	0
Y7 VALUE2	Y7 Output Value (Y Axis)	0 to 99.99 %	0
Y8 VALUE2	Y8 Output Value (Y Axis)	0 to 99.99 %	0

Table 3-7 continued on next page

Function prompts (continued)

Table 3-7 Algorithm Group Function Prompts, continued

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
POLYNOM	Polynomial Equation	DISABLE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5	DISABLE
C0 VALUE	Polynomial Coefficient C0	–99.99 to 99.99	0
C1 VALUE	Polynomial Coefficient C1	–9.999 to 9.999	0
C2 X 10-1	Polynomial Coefficient C2	–9.999 to 9.999	0
C3 X 10-3	Polynomial Coefficient C3	–9.999 to 9.999	0
C4 X 10-5	Polynomial Coefficient C4	–9.999 to 9.999	0
C4 X 10-7	Polynomial Coefficient C5	–9.999 to 9.999	0
TOTALIZER	Totalization Function	DISABLE INPUT 1 L1 IN ALG L2 IN ALG	DISABLE
ΣXXXXXXXX	Current Scale Factor (upper display) Actual Current Totalized Value (lower display)	Σ * En Where: n=Integer Scale Factor Value	- -
TOT SCALE	Totalizer Scale Factor	*E0 *E1 *E2 *E3 *E4 *E5 *E6	E0
TOT SECUR	Totalizer Reset Lock	UNLOCK LOCK	UNLOCK
Σ RESET ?	Totalizer Reset	NO YES	NO
TOT RATE	Totalizer Rate of Integration	SECOND MINUTE HOUR DAY MIL/DAY	SECOND

3.11 Advanced Math Parameters Set Up Group

Introduction

This data deals with various Logic Gates that are available for use in the controller. It also lists what each of the two inputs and the output can represent. Up to 5 different gates can be configured.

Function prompts

Table 3-8 lists all the function prompts in the “ADVANCED MATH” Set Up group.

Table 3-8 Advanced Math Group Function Prompts

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
LOG GATES	Logic Gate Function (for each gate, make selection for: Gate Type Input A Source Input B Source Output Use)	ENABLE DISABLE	DISABLE
GATEnTYPE **(n =1,2,3,4,or 5)**	Gate n Type (n =1,2,3,4,or 5)	NOT USED OR NOR AND NAND X OR X NOR B LT A B GT A	NOT USED

Table 3-8 continued on next page

Function prompts (continued)

Table 3-8 Advanced Math Group Function Prompts, continued

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
GATE n INA **(n =1,2,3,4,or 5)**	Gate n Input A (n =1,2,3,4,or 5)	**Digital Selections(OR thru XNOR):** DIG IN 1 DIG IN 2 DIG OUT 1 DIG OUT 2 DIG OUT 3 DIG OUT 4 GATE1OUT GATE2OUT GATE3OUT GATE4OUT GATE5OUT FIXED ON FIXED OFF M/A MODE L/R SP 1 DIS/EN AT M/A MODE 2* L/R SP 2* DIS/ENAT2* **Analog Selections(GT or LT):** INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 LOOP 1 PV LOOP 1 SP CONSTANT K LOOP 2 PV* LOOP 2 SP* * appears only when 2Loops are configured.	CONST K
GATE n K **(n =1,2,3,4,or 5)**	K Constant for "GATE n INA" prompt selection "CONST K".	–999.0 to +9999	0

Table 3-8 continued on next page

Function prompts (continued)

Table 3-8 Advanced Math Group Function Prompts, continued

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
GATE n INB **(n =1,2,3,4,or 5)**	Gate n Input B (n =1,2,3,4,or 5)	**Digital Selections(OR thru XNOR):** DIG IN 1 DIG IN 2 DIG OUT 1 DIG OUT 2 DIG OUT 3 DIG OUT 4 GATE1OUT GATE2OUT GATE3OUT GATE4OUT GATE5OUT FIXED ON FIXED OFF M/A MODE L/R SP 1 DIS/EN AT M/A MODE 2* L/R SP 2** DIS/ENAT2 **Analog Selections(GT or LT):** INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 LOOP 1 PV LOOP 1 SP TOTALIZER LOOP 2 PV* LOOP 2 SP* * appears only when 2Loops are configured.	FIXED OFF
GATE n OUT **(n =1,2,3,4,or 5)**	GATE n Output Selection (n =1,2,3,4,or 5)	DIG OUT 1 DIG OUT 2 DIG OUT 3 DIG OUT 4 ANY GATE M/A MODE L/R SP L1 DIS/EN AT RESET TOT M/A MODE 2 L/R SP L2 DIS/ENAT 2	ANY GATE

3.12 Output Algorithm Parameters Set Up Group

Introduction

This data deals with various Output types that are available for use in the controller. It also lists the Digital Output Status, and the Current Duplex functionality.

Function prompts

Table 3-9 lists all the function prompts in the "OUT ALG" Set Up group.

Table 3-9 Output Algorithm Group Function Prompts

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
OUT ALG	Loop 1 Output Algorithm	TIME CURRENT TIME DPLX CUR DPLX CUR TIME TIME CUR	CURRENT
4–20 RNG	Current Duplex Range	100PCT 50PCT	100PCT
OUT2 ALG	Loop 2 Output Algorithm	NONE TIME CURRENT CUR DPLX CUR TIME TIME CUR	CURRENT
DO STATE	Digital Output State at 0% Output	3OFF 4OFF 3ON 4ON 3OFF 4ON 3ON 4OFF	3OFF 4ON

3.13 Input 1 Through 4 Parameters Set Up Group

Introduction

This data deals with various parameters required to configure Input 1 through 4. The number of the Input group you are working with will appear in each prompt.

Function prompts

Table 3-10 lists all the function prompts in the “INPUT 1 through 4” Set Up groups.

Table 3-10 Input 1 through 4 Set Up Groups Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
XMITTERn **n = 1, 2, 3, or 4**	Transmitter Characterization **ATTENTION** Change of input characterization selection results in loss of any field calibration and restores factory calibration of linear range 1 to 5 Volts.	DISABLE B TC T TC E TC W TC J TC 100 PT K TC 100 PT LO NNM TC 200 PT NIC TC 500 PT R TC LINEAR S TC SQROOT IN2 No R/B(Xmitter 4 only)	LINEAR
INn HIGH **n = 1, 2, 3, or 4**	Input n High Range Value (Adjustable for Linear or Square Root characterization only)	–999 to 9999 in engineering units	1000
INn LOW **n = 1, 2, 3, or 4**	Input n Low Range Value (Adjustable for Linear or Square Root characterization only)	–999 to 9999 in engineering units	0
RATIO n **n = 1, 2, 3, or 4**	Input n Ratio Value	–20.00 to 20.00	1.0
BIAS IN n **n = 1, 2, 3, or 4**	Input n Bias Value	–999 to 9999.	0
FILTER n **n = 1, 2, 3, or 4**	Input n Filter	0 to 120 seconds	0
DEADTIME3	Deadtime for **Input 3 only**	0.0 to 60.0 Minutes	0

Table 3-10 continued on next page

3.14 Input 5 Parameters Set Up Group

Introduction

This data deals with various parameters required to configure Input 5.

Function prompts

Table 3-11 lists all the function prompts in the INPUT 5 Set Up group.

Table 3-11 Input 5 Group Function Prompts

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
IN 5 TYPE	Input 5 Type **ATTENTION** Change of input type selection results in loss of any field calibration and restores factory calibration.	DISABLE B TC 100 PT E TC 100 PT LO J TC 200 PT K TC 500 PT NNM TC RH RADIAM NIC TC MILLIAMPS R TC 0–10MV S TC 10–50MV T TC 1–5V W TC 0–10V PULSE	DISABLE
IN5 PULSE	Input 5 Actuation when a Pulse Input Board is used	DISABLE FREQ INP PULSE	DISABLE
XMITTER5	Transmitter Characterization	DISABLE B TC T TC E TC W TC J TC 100 PT K TC 100 PT LO NNM TC 200 PT NIC TC 500 PT R TC LINEAR S TC SQROOT	LINEAR
IN5 HIGH	Input 5 High Range Value	–999 to 9999 in engineering units (Adjustable for linear inputs only)	1000
IN5 LOW	Input 5 Low Range Value	–999 to 9999 in engineering units (Adjustable for linear inputs only)	0
RATIO 5	Input 5 Ratio Value	–20.00 to 20.00	1.0
BIAS IN5	Input 5 Bias Value	–999 to 9999 in engineering units	0
FILTER 5	Input 5 Filter	0 to 120 seconds 0 = No Filter	0
BURNOUT5	Sensor Break Protection	NONE UP DOWN	NONE
EMISSIV 5	Emissivity for RH Radiam	0.01 to 1.00	1.0

3.15 Loop 1 Control Parameters Set Up Group

Introduction

The functions listed in this group define how the Single Loop process controller or Loop 1 of a Two Loop process controller will control the process.

Function prompts

Table 3-12 lists all the function prompts in the "CONTROL" Set Up group.

Table 3-12 Control Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
PV SOURCE	Process Variable Source	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 IN ALG 1 IN ALG 2	INPUT 1
PID SETS	Tuning Parameter Sets	1 ONLY 2KEYBD 2PV SW 2SP SW GAIN SCDL	1 ONLY
SW VALUE	Automatic Switchover Value	Value in Engineering Units within Input Range	0.00
LSP'S	Local Setpoint Source	1 ONLY TWO THREE	1 ONLY
RSP SOURC	Remote Setpoint Source	NONE INPUT 2 INPUT 3 INPUT 4 INPUT 5 IN ALG 1 IN ALG 2	NONE
AUTO BIAS	Automatic Bias	ENABLE DISABLE	DISABLE
SP TRACK	Local Setpoint Tracking	NONE PV RSP	NONE
PWR MODE	Power Up Mode Recall	MANUAL A or M SP A or M LSP	A or M SP
SP HILIM	Setpoint High Limit	0 to 100% of span input in engineering units	1000
SP LOLIM	Setpoint Low Limit	0 to 100% of span input in engineering units	0

Table 3-12 continued on next page

Function prompts, continued

Table 3-12 lists all the function prompts in the "CONTROL" Set Up group.

Table 3-12 Control Group Function Prompts, continued

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
ACTION	Control Output Direction	DIRECT REVERSE	REVERSE
OUT RATE	Output Change Rate	ENABLE DISABLE	DISABL
PCT/MIN UP	Output Rate Up Value	0 to 9999% / minute	0
PCT/MIN DN	Output Rate Down Value	0 to 9999% / minute	0
OUTHILIM	High Output Limit	–5.0 to 105.0% of output	100.0
OUTLOLIM	Low Output Limit	–5.0 to 105.0% of output	0.0
I HI LIM	High Reset Limit	Within the range of the output limits	100.0
I LO LIM	Low Reset Limit	Within the range of the output limits	0.0
DROPOFF	Controller Dropoff Value	–5.0 to 105.0% of output	0.0
DEADBAND	Output Relay Deadband	*Duplex: only* –5.0 to 25.0% *All others* 0.0 to 25.0%	1.0
OUT HYST	Output Relay Hysteresis	0.0 to 5.0% of PV Span for On/Off control	0.5
FAILMODE	Failsafe Mode	NON LATCH LATCHING	NON LATCH
FAILSAFE	Failsafe Output Value	Set within the range of the output limits. 0 to 100%	0.0
PBorGAIN	Proportional Band or Gain Units	PB PCT GAIN	GAIN
MINorRPM	Reset Units	R P M M I N	MIN

3.16 Loop 2 Control Parameters Set Up Group

Introduction

The functions listed in this group define how Loop 2 of a Two Loop process controller will control the process..

Function prompts

Table 3-13 lists all the function prompts in the "CONTROL2" Set Up group.

Table 3-13 Control2 Group Function Prompts

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
PV 2 SRC	Process Variable Source	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 IN ALG 1 IN ALG 2	INPUT 2
PID SETS	Tuning Parameter Sets	1 ONLY 2KEYBD 2PV SW 2SP SW GAIN SCDL	1 ONLY
SW VALUE	Automatic Switchover Value	Value in Engineering Units within Input Range	0.00
LSP'S	Local Setpoint Source	1 ONLY TWO THREE	1 ONLY
RSP SOURC	Remote Setpoint Source	NONE INPUT 2 INPUT 3 INPUT 4 INPUT 5 IN ALG 1 IN ALG 2	NONE
AUTO BIAS	Automatic Bias	ENABLE DISABLE	DISABLE
SP TRACK	Local Setpoint Tracking	NONE PV RSP	NONE
SP HILIM	Setpoint High Limit	0 to 100% of PV span input in engineering units	1000
SP LOLIM	Setpoint Low Limit	0 to 100% of PV span input in engineering units	0

Table 3-13 continued on next page

Function prompts, continued

Table 3-13 lists all the function prompts in the "CONTROL2" Set Up group.

Table 3-13 Control2 Group Function Prompts, continued

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
ACTION	Control Output Direction	DIRECT REVERSE	REVERSE
OUT RATE	Output Change Rate	ENABLE DISABLE	DISABL
PCT/MIN UP	Output Rate Up Value	0 to 9999% / minute	0
PCT/MIN DN	Output Rate Down Value	0 to 9999% / minute	0
OUTHILIM	High Output Limit	–5.0 to 105.0% of output	100.0
OUTLOLIM	Low Output Limit	–5.0 to 105.0% of output	0
I HI LIM	High Reset Limit	Within the range of the output limits	100.0
I LO LIM	Low Reset Limit	Within the range of the output limits	0.0
DROPOFF	Controller Dropoff Value	–5.0 to 105.0% of output	0.0
DEADBAND	Output Relay Deadband	*Duplex: only* –5.0 to 25.0% *All others* 0.0 to 25.0%	1.0
FAILMODE	Failsafe Mode	NON LATCH LATCHING	NON LATCH
FAILSAFE	Failsafe Output Value	Set within the range of the output limits. 0 to 100%	0.0

3.17 Options Set Up Group

Introduction

This data deals with data that covers the 2nd Current Output and the Two Digital Inputs. If your controller does not have any of these options, the prompts will not appear.

Function prompts

Table 3-14 lists all the function prompts in the "Options" Set Up group.

Table 3-14 Options Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
CUR OUT 2	2nd Current Output Option	DISABL INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 PV DEVIATION OUTPUT SP LSP1 IN ALG 1 IN ALG 2 PV LOOP2 DEV LOOP2 OUTPUT 2 SP LOOP 2 LSP1 LP 2	DISABLE
4mA VALUE	Low Scaling Factor	Low scale value to represent 4 mA.	0.0
20mA VALU	High Scaling Factor	High scale value to represent 20 mA.	100.0
DIG IN 1	Digital Input 1 selections	NONE TO MANUAL TO SP 1 TO SP 2 TO SP 3 TO DIRECT TO HOLD TO PID 2 PV IS IN2 PV IS IN3 PV IS IN4 PV IS IN5 TO RUN MAN FSAFE TRACK 1 TRACK 2 TO OUT 2 PULSEDOWN OUT 3 ON OUT 4 ON INHIBIT 1 TO RSP DSP L1/L2 RESET FB TOA/M STA To PURGE LOW FIRE ToTUNE	NONE

Table 3-14 continued on next page

Function prompts, continued

Table 3-14 lists all the function prompts in the "Options" Set Up group.

Table 3-14 Options Group Function Prompts, continued

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
DIG1 COMB	Digital Input 1 Combinations	DISABLE +TO PID2 +TO DIR +TO SP2 +DIS ADT1 +TO SP1 +TO RUN	DISABLE
DIG IN 2	Digital Input 2 selections	Same as DIG IN 1	NONE
DIG 2 COMB	Digital Input 2 Combinations	DISABLE +TO PID2 +TO DIR +TO SP2 +DIS ADT2 +TO SP1 +TO RUN	DISABLE
DIG IN 3	Digital Input 3 selections	NONE TO MANUAL TO SP1 TO SP2 TO SP3 TO RUN TO HOLD TO PID2 PV IS IN1 PV IS IN2 PV IS IN3 PV IS IN4 PV IS IN5 RSP - IN1* RSP - IN2 RSP - IN3 RSP - IN4 RSP - IN5 TO DIRECT MAN FSAFE ToA/M STA TO PURGE LOW FIRE * Digital Input Only	NONE
DIG IN 4	Digital Input 4 selections	Same as DIG IN 3	NONE
DIG IN 5	Digital Input 5 selections	Same as DIG IN 3	NONE
DIG IN 6	Digital Input 6 selections	Same as DIG IN 3	NONE
DI ON LP1	Assigned to Loop 1	DI3,4,5,6 DI3,4,5 DI3,4 DI3	DI3,4,5,6
LATCHING	Purge/Low Fire action	NONE, PURGE, LOW FIRE, BOTH	NONE

3.18 Communications Group

Introduction

This option allows the controller to be connected to a host computer by way of various communications options.

The controller looks for messages from the computer at regular intervals. If these messages are not received within the configured shed time, the controller will SHED from the communications link and return to stand alone operation.

The device address, parity, baud rate, Computer Setpoint, Units, Ratio, and Bias are configurable *depending on the protocol* you are using.

You can also set the SHED output mode and setpoint recall, and communication units.

Up to 99 addresses can be configured over this link.

485TDC option
Up to four RS485 link addresses are allowed when the communication option is selected as 485TDCSDI. One PV Point and one OP point are required to be configured **per loop** when the UDC6300 TDC integration schematics are to be used for Operator Interface from the TDC Universal Station. Remote Cascade Option and overall mode of Operation can also be configured.

Function prompts

Table 3-15 lists all the function prompts in the "Commun" Set Up group.

Table 3-15 Commun Group Function Prompts

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
COM STATE	Communications Selection	DISABL 485MODRTU 485DMCS 485TDCSDI 422ASCII 485BSAP	DISABL
ADDRESS *485DMCS, 422ASCII, 485MODRTU, 485BSAP*	Loop 1 Communications Station Address	1 to 99	0
ADDRESS2 *485ASCII only*	Loop 2 Communications Station Address	1 to 99	0
PV1 SLOT *485TDCSDI only*	Loop 1 Process Variable (PV) Point Address	0 to 16	0
OP1 SLOT *485TDCSDI only*	Loop 1 Output (OP) Point Address	0 to 16	
PV2 SLOT *485TDCSDI only*	Loop 2 Process Variable (PV) Point Address	0 to 16	
OP2 SLOT *485TDCSDI only*	Loop 2 Output (OP) Point Address	0 to 16	
PARITY *485ASCII only*	Parity	ODD EVEN	ODD
BAUD RATE *485 ASCII only*	**Baud Rate** **NOTE: If you make a change in Baud Rate, cycle the power supply after you make the change.**	300 1200 4800 19200 600 2400 9600 38400	300
FRAMING *422ASCII, 485MODRTU only*	Framing	DEFAULT 50MSEC 10MSEC 100MSEC 25MSEC	
XMT DELAY	Transmission Delay	NONE 20MSEC 40MSEC 10MSEC 30MSEC 50MSEC	

Table 3-15 continued on next page

Function prompts, continued

Table 3-15 Commun Group Function Prompts, continued

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
DUPLEX *Does not apply to 485TDCSDI*	Transmission Response	HALF FULL	FULL
DATA FORM *485MODRTU only*	Transmission Data Format	INTEGER FLOAT POINT	INTEGER
UNITS	Communication Units	PERCENT ENG	PERCENT
BOX MODE	Overall Mode of UDC6300 Operation	BASIC MODE FULL MODE	FULL
SHEDTIME	Shed Time	1 to 255 sample periods 0 = No Shed	0
SHEDMODE	Shed Controller Mode and Output Level for Loop 1	LAST TO MAN FSAFE ToAUTO	LAST
SHED SP	Shed Setpoint Recall for Loop 1	TO LSP TO CSP	TO LSP
CSP RATIO	Loop 1 Computer Setpoint Ratio	–20.00 to 20.00	1.00
CSP BIAS	Loop 1 Computer Setpoint Bias	–999.0 to 9999	0.0
RCASMODE *485TDCSDI only*	Remote Cascade Option for Loop 1	SPC DDC M/A STN	SPC
SHED2MODE	Shed Controller Mode and Output Level for Loop 2	LAST TO MAN FSAFE ToAUTO	LAST
SHED2 SP	Shed Setpoint Recall for Loop 2	TO LSP TO CSP	TO LSP
CSP2 RATIO	Loop 2 or Cascade Computer Setpoint Ratio	–20.00 to 20.00	1.00
CSP2 BIAS	Loop 2 or Cascade Computer Setpoint Bias	–999.0 to 9999	0.0
RCAS2MOD *485TDCSDI only*	Remote Cascade Option for Loop 2	SPC DDC M/A STN	SPC
TEST COM *(replaces LOOPBACK)*	Test Communications	DISABL ENABLE	DISABL

3.19 Alarms Set Up Group

Introduction

This data deals with the Alarms function that is available with your controller.

There are up to four alarms available. Each alarm has two setpoints.

You can configure each of these two setpoints to alarm on one of several events, and you can configure each setpoint to alarm High or Low.

ATTENTION

Alarm 1 = Digital Output 1
Alarm 2 = Digital Output 2
Alarm 3 = Digital Output 3
Alarm 4 = Digital Output 4

Function prompts

Table 3-16 lists all the function prompts in the “Alarms” Set Up group.

Table 3-16 Alarms Group Function Prompts

Function Prompt Lower Display	Function Name	Selections or Range of Setting Upper Display	Factory Setting
A1S1 VALU	Alarm 1, Setpoint 1 Value	Within the range of selected parameter or PV Span for Deviation Alarm	90
A1S2 VALU	Alarm 1, Setpoint 2 Value	Within the range of selected parameter or PV Span for Deviation Alarm	10
A2S1 VALU	Alarm 2, Setpoint 1 Value	Within the range of selected parameter or PV Span for Deviation Alarm	95
A2S2 VALU	Alarm 2, Setpoint 2 Value	Within the range of selected parameter or PV Span for Deviation Alarm	5
A3S1 VALU	Alarm 3, Setpoint 1 Value	Within the range of selected parameter or PV Span for Deviation Alarm	90
A3S2 VALU	Alarm 3, Setpoint 2 Value	Within the range of selected parameter or PV Span for Deviation Alarm	10
A4S1 VALU	Alarm 4, Setpoint Value	Within the range of selected parameter or PV Span for Deviation Alarm	95
A4S2 VALU	Alarm 4, Setpoint 2 Value	Within the range of selected parameter or PV Span for Deviation Alarm	5

Table 3-16 continued on next page

Function prompts, continued

Table 3-16 lists all the function prompts in the "Alarms" Set Up group.

Table 3-16 Alarms Group Function Prompts, continued

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
A1S1 TYPE	Alarm 1, Setpoint 1 Type	NONE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 PV (Process Variable) DEVIATION OUTPUT SHED (Communications) REM SP REM SP2 PV 2 DEV 2 OUTPUT 2 MANUAL MANUAL2 FAILSAFE FAILSAFE2	OUTPUT
A1S2 TYPE	Alarm 1, Setpoint 2 Type	Same as A1S1TYPE	OUTPUT
A2S1 TYPE	Alarm 2, Setpoint 1 Type	Same as A1S1TYPE	OUTPUT
A2S2 TYPE	Alarm 2, Setpoint 2 Type	Same as A1S1TYPE	OUTPUT
A3S1 TYPE	Alarm 3, Setpoint 1 Type	Same as A1S1TYPE	OUTPUT
A3S2 TYPE	Alarm 3, Setpoint 2 Type	Same as A1S1TYPE	OUTPUT
A4S1 TYPE	Alarm 4, Setpoint 1 Type	Same as A1S1TYPE	OUTPUT
A4S2 TYPE	Alarm 4, Setpoint 2 Type	Same as A1S1TYPE	OUTPUT
A1S1 H L	Alarm 1, Setpoint 1 State	LOW HIGH	HI
A1S2 H L	Alarm 1, Setpoint 2 State	LOW HIGH	LO
A2S1 H L	Alarm 2, Setpoint 1 State	LOW HIGH	HI
A2S2 H L	Alarm 2, Setpoint 2 State	LOW HIGH	LO
A3S1 H L	Alarm 3, Setpoint 1 State	LOW HIGH	HI
A3S2 H L	Alarm 3, Setpoint 2 State	LOW HIGH	LO

Continued on next page

Function prompts, continued

Table 3-16 lists all the function prompts in the "Alarms" Set Up group.

Table 3-16 Alarms Group Function Prompts, continued

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
A4S1 H L	Alarm 4, Setpoint 1 State	LOW HIGH	HI
A4S2 H L	Alarm 4, Setpoint 2 State	LOW HIGH	LO
AL HYST	Alarm Hysteresis	0.0 to 5.0 % of Output or Span as appropriate	0.1
ALM ACTN	Alarm Relay Coil Action	ENERGIZE DE ENERGIZ	ENERGIZE
ALM OUT 1	Latching Alarm for Output 1*	NON LATCH LATCHING	NON LATCH
ALM OUT 2	Latching Alarm for Output 2*	NON LATCH LATCHING	NON LATCH
ALM OUT 3	Latching Alarm for Output 3*	NON LATCH LATCHING	NON LATCH
ALM OUT 4	Latching Alarm for Output 4*	NON LATCH LATCHING	NON LATCH

* For CE conformity, Performance Criterion A, select 'NON-LATCHING"

3.20 Display Parameters Set Up Group

Introduction

This data deals with the Decimal Place, Units of Temperature, Power Frequency, and Process ID Tag.

Function prompts

Table 3-17 lists all the function prompts in the "Display" Set Up group.

Table 3-17 Display Group Function Prompts

Function Prompt Lower Display	**Function Name**	**Selections or Range of Setting** Upper Display	**Factory Setting**
DECIMAL	Control Loop 1 Decimal Place	XXXX XXX.X XX.XX X.XXX **ATTENTION** Auto-ranging will occur to whichever decimal place has been selected.	XXXX
DECIMAL2	Control Loop 2 Decimal Place	XXXX XXX.X XX.XX X.XXX	XXXX
TEMP UNIT	Control Loop 1 Temperature Units	DEG F DEG C NONE	NONE
PWR FREQ	Power Frequency	60 Hertz 50 Hertz	60HZ
2 LOOP DIS	Bargraph Display	SPnPVnOn L1 L2 On L1 — On — L2 On	SPnPVnON
SP GRAPH	Setpoint Indication	FULL ONE BAR	FULL
ID TAG	Identification Tag	DISABLE ENABLE	ENABLE
PV TAG	Process Variable Tag	DISABLE ENABLE	DISABLE
PV TAG2	Process Variable Tag	DISABLE ENABLE	DISABLE
TAG	ID or PV tag ConfigurationTag	Letters: A to Z Numbers: 0 to 9 Others: >, <, #, /, \, . ⌈, (blank), –, ., °, =, ?,_, ^, V, +, *	- -
RATIO4SET	Ratio for Input 4 - Set from the front of the controller	DISABLE LOWR DISP	DISABLE
LANGUAGE	Display Language	ENGLISH FRENCH GERMAN	ENGLISH

3.21 Calib Group

Calibration data

The prompts used here are for field calibration purposes.
Refer to *Section 6– Input Calibration* in this manual for complete information and instructions.

3.22 Status Group

Status Test Data

The prompts used here are read only.
They are used to determine the reason for a controller failure.
Refer to *Section 8– Troubleshooting* in this manual for complete information.

3.23 Configuration Record Sheet

Keep a record

Enter the value or selection for each prompt on this sheet so you will have a record of how your controller was configured.

Group Prompt	Function Prompt	Value or Selection	Factory Setting
TUNING	PROP BD		- -
	or		
	GAIN		1.0
	GAIN VALn	Read Only	
	RATE MIN		0
	RSET MIN		1.00
	or		
	RSET RPM		- -
	or		
	MAN RSET		0
	PROP BD2		- -
	or		
	GAIN 2		1.0
	RATE2MIN		0
	RSET2MIN		1.00
	or		
	RSET2RPM		- -
	CYCSEC		4
	CYC2SEC		4
	SECURITY		0
	LOCKOUT		CALIB
	PVEU VAL1		0
	PVEU VAL2		0
	PVEU VAL3		0
	PVEU VAL4		0
	PVEU VAL5		0
	PVEU VAL6		0
	PVEU VAL7		0
	PVEU VAL8		0
	GAIN VAL1		1.0
	GAIN VAL2		1.0
	GAIN VAL3		1.0
	GAIN VAL4		1.0
	GAIN VAL5		1.0
	GAIN VAL6		1.0
	GAIN VAL7		1.0
	GAIN VAL8		1.0
TUNINGL2	PROP BD3		- -
	or		
	GAIN3		1.0
	GAIN VALn	Read Only	
	RATE3MIN		0
	RSET3MIN		1.0
	or		
	RSET3RPM		- -
	or		
	MAN3RSET		0
	PROP BD4		- -
	or		
	GAIN 4		1.0
	RATE4MIN		0
	RSET4MIN		1.0
	or		
	RSET4RPM		- -
	CYC3SEC		4
	CYC4SEC		4
	PVEU VAL1		0
	PVEU VAL2		0

Group Prompt	Function Prompt	Value or Selection	Factory Setting
TUNINGL2 (Continued)	PVEU VAL3		0
	PVEU VAL4		0
	PVEU VAL5		0
	PVEU VAL6		0
	PVEU VAL7		0
	PVEU VAL8		0
	GAIN VAL1		1.0
	GAIN VAL2		1.0
	GAIN VAL3		1.0
	GAIN VAL4		1.0
	GAIN VAL5		1.0
	GAIN VAL6		1.0
	GAIN VAL7		1.0
	GAIN VAL8		1.0
SP RAMP	SP RAMP		DISABLE
	TIME MIN		3
	FINAL SP		1000
	SP RATE		0
	EU/HR UP		0
	EU/HR DN		0
	EU/HR UP2		0
	EU/HR DN2		0
ACCUTUNE	FUZZY		DISABLE
	ACCUTUNE		DISABLE
	ACCUTUNE2		DISABLE
	SP CHANG		10
	PROC GAIN		1.0
	CRITERIA		FAST
	SPCHANG2		10
	PROCGAN2		1.0
	CRITERIA2		FAST
ALGORITHM	LOOP RATE		1.3X 2.3X
	CONTR ALG		PID A
	MTR TIME		0
	PID LOOPS		1 or 2
	CONT2ALG		PID A
	OUT OVRD		DISABLE
	IN ALG 1		NONE
	CONSTNT K		- -
	CALC HIGH		- -
	CALC LOW		- -
	ALG1 INA		- -
	ALG1 INB		- -
	ALG1 INC		- -
	IN ALG 2		NONE
	CONST K2		- -
	CALC HIGH		- -
	CALC LOW		- -
	ALG2 INA		- -
	ALG2 INB		- -
	ALG2 INC		- -
	8SEG CHAR		DISABLE
	X0 VALUE		0
	X1 VALUE		0
	X2 VALUE		0
	X3 VALUE		0
	X4 VALUE		0
	X5 VALUE		0
	X6 VALUE		0

Continued next page

3.23 Configuration Record Sheet, Continued

Group Prompt	Function Prompt	Value or Selection	Factory Setting	Group Prompt	Function Prompt	Value or Selection	Factory Setting
ALGORITHM	X7 VALUE		0	**ADV MATH**	GATE4TYP		NOT USED
(continued)	X8 VALUE		0	**(continued)**	GATE4INA		CONST K
	Y0 VALUE		0		GATE4 K		0
	Y1 VALUE		0		GATE4 INB		FIXED OFF
	Y2 VALUE		0		GATE4 OUT		ANY GATE
	Y3 VALUE		0		GATE5TYP		NOT USED
	Y4 VALUE		0		GATE5 INA		CONST K
	Y5 VALUE		0		GATE5 K		0
	Y6 VALUE		0		GATE5 INB		FIXED OFF
	Y7 VALUE		0		GATE5 OUT		ANY GATE
	Y8 VALUE		0				
	8SEG CHA2		DISABLE	**OUT ALG**	OUT ALG		CURRENT
	X0 VALUE2		0		4–20 RNG		100 PCT
	X1 VALUE2		0		OUT2 ALG		CURRENT
	X2 VALUE2		0		DO STATE		3OFF 4ON
	X3 VALUE2		0				
	X4 VALUE2		0	**INPUT 1**	XMITTER1		LINEAR
	X5 VALUE2		0		IN1 HIGH		1000
	X6 VALUE2		0		IN1 LOW		0
	X7 VALUE2		0		RATIO 1		1.00
	X8 VALUE2		0		BIAS IN1		0
	Y0 VALUE2		0		FILTER 1		0
	Y1 VALUE2		0				
	Y2 VALUE2		0	**INPUT 2**	XMITTER2		DISABLE
	Y3 VALUE2		0		IN2 HIGH		1000
	Y4 VALUE2		0		IN2 LOW		0
	Y5 VALUE2		0		RATIO 2		1.00
	Y6 VALUE2		0		BIAS IN2		0
	Y7 VALUE2		0		FILTER 2		0
	Y8 VALUE2		0				
	POLY NOM		DISABLE	**INPUT 3**	XMITTER3		DISABLE
	C0 VALUE		0		IN3 HIGH		1000
	C1 VALUE		0		IN3 LOW		0
	C2 X 10-1		0		RATIO 3		1.00
	C3 X 10-3		0		BIAS IN3		0
	C4 X 10-5		0		FILTER 3		0
	C5 X 10-7		0		DEADTIME3		0
	TOTALIZER		DISABLE				
	E XXXXXXX		- -	**INPUT 4**	XMITTER4		DISABLE
	TOT SCALE		E0		IN4 HIGH		1000
	TOT SECUR		UNLOCK		IN4 LOW		0
	E RESET ?		NO		RATIO 4		1.00
	TOT RATE		SECOND		BIAS IN4		0
					FILTER 4		0
ADV MATH	LOGGATES		DISABLE				
	GATE1TYP		NOT USED	**INPUT 5**	IN5 TYPE		DISABLE
	GATE1INA		CONST K		IN5 PULSE		DISABLE
	GATE1 K		0		XMITTER 5		LINEAR
	GATE1 INB		FIXED OFF		IN5 HIGH		1000
	GATE1 OUT		ANY GATE		IN5 LOW		0
	GATE2TYP		NOT USED		RATIO IN5		1.00
	GATE2INA		CONST K		BIAS IN5		0
	GATE2 K		0		FILTER 5		0
	GATE2 INB		FIXED OFF		BURNOUT5		NONE
	GATE2 OUT		ANY GATE	Continued	EMISSIV5		1.0
	GATE3TYP		NOT USED	next page			
	GATE3INA		CONST K				
	GATE3 K		0				
	GATE3 INB		FIXED OFF				
	GATE3 OUT		ANY GATE				

Group Prompt	Function Prompt	Value or Selection	Factory Setting	Group Prompt	Function Prompt	Value or Selection	Factory Setting
CONTROL	PVSOURCE		IN 1	**COMMUN**	COMSTATE		DISABLE
	PID SETS		1 ONLY		ADDRESS		0
	SW VALUE		0		ADDRESS2		0
	LSP's		1 ONLY		SHED TIME		LAST
	RSPSRC		NONE		PARITY		ODD
	AUTO BIAS		DISABLE		BAUD		19200
	SP TRACK		NONE		SHEDMODE		LAST
	PWR MODE		A or M SP		SHED SP		TO LSP
	SP HI LIM		1000		UNITS		PERCENT
	SP LO LIM		0		CSP RATIO		1.00
	ACTION		REVERSE		CSP BIAS		0.0
	OUT RATE		DISABLE		CSP2RATIO		1.00
	PCT/MIN UP		0		CSP2BIAS		0.0
	PCT/MIN DN		0		LOOPBACK		DISABLE
	OUTHILIM		100.0				
	OUTLOLIM		0.0	**ALARMS**	A1S1 VALU		90
	I HILIM		100.0		A1S2 VALU		10
	I LOLIM		0.0		A2S1 VALU		95
	DROPOFF		0.0		A2S2 VALU		5
	DEADBAND		1.0		A3S1 VALU		90
	OUT HYST		0.5		A3S2 VALU		10
	FAILMODE		NON LATCH		A4S1 VALU		95
	FAILSAFE		0.0		A4S2 VALU		5
	PBorGAIN		GAIN		A1S1TYPE		OUTPUT
	MINorRPM		MIN		A1S2TYPE		OUTPUT
					A2S1TYPE		OUTPUT
CONTROL2	PV2 SRC		IN 2		A2S2TYPE		OUTPUT
	PID SETS		1 ONLY		A3S1TYPE		OUTPUT
	SW VALUE		0		A3S2TYPE		OUTPUT
	LSP's		1 ONLY		A4S1TYPE		OUTPUT
	RSPSOURC		NONE		A4S2TYPE		OUTPUT
	AUTO BIAS		DISABLE		A1S1 H L		HI
	SP TRACK		NONE		A1S2 H L		LO
	SP LOLIM		0.0		A2S1 H L		HI
	SP HILIM		100.0		A2S2 H L		LO
	ACTION		REVERSE		A3S1 H L		HI
	OUT RATE		DISABLE		A3S2 H L		LO
	PCT/MIN UP		0		A4S1 H L		HI
	PCT/MIN DN		0		A4S2 H L		LO
	OUTHILIM		100.0		AL HYST		0.1
	OUTLOLIM		0.0		ALM ACT		ENERGIZE
	I HILIM		100.0		ALM OUT1		NON LATCH
	I LOLIM		0.0		ALM OUT2		NON LATCH
	DROPOFF		0.0		ALM OUT3		NON LATCH
	DEADBAND		1.0		ALM OUT4		NON LATCH
	FAILMODE		NON LATCH				
	FAILSAFE		0.0				
	CUR OUT 2		OUTPUT 2				
OPTIONS	4mA VAL		0.0				
	20mA VAL		100.0				
	DIG IN1		NONE				
	DIG1 COMB		DISABLE				
	DIG IN2		NONE				
	DIG2 COMB		DISABLE				
	DIG IN3		DISABLE				
	DIG IN4		DISABLE				
	DIG IN5		DISABLE				
	DIG IN6		DISABLE				
	DI ON LP1		DI3,4,5,6				
	LATCHING		NONE				

Continued on next page

3.23 Configuration Record Sheet, Continued

Group Prompt	Function Prompt	Value or Selection	Factory Setting	Group Prompt	Function Prompt	Value or Selection	Factory Setting
DISPLAY	DECIMAL	__________	XXXX				
	DECIMAL2	__________	XXXX				
	TEMPUNIT	__________	NONE				
	PWR FREQ	__________	60HZ				
	SP GRAPH	__________	DISABLE				
	2LOOP DIS	__________	FULL				
	ID TAG	__________	ENABLE				
	PV TAG	__________	DISABLE				
	PV TAG 2	__________	DISABLE				
	TAG	__________	---				
	RATIO4SET	__________	DISABLE				
	LANGUAGE	__________	ENGLISH				

Section 4 – Configuration Prompt Definitions

4.1 Overview

Introduction

This section provides information for all the user configurable parameters listed in the *Section 3 - Configuration.* If you aren't familiar with these parameters, this section gives you the parameter prompt, the selection or range of setting that you can make, and a definition of how each parameter setting affects controller performance. It will also refer you to any other prompts that might be affected by your selection.

What's in this section?

The table below lists the topics that are covered in this section. They are listed in the order of their appearance in the controller.

Topic		See Page
4.1	Overview	71
4.2	Tuning Parameters Set Up Group	72
4.3	Tuning L2 Parameters Set Up Group	76
4.4	Setpoint Ramp/Rate Set Up Group	77
4.5	Accutune Set Up Group	79
4.6	Algorithm Data Set Up Group	82
4.7	Advanced Math Set Up Group	98
4.8	Output Algorithm Set Up Group	104
4.9	Input 1, 2, 3, or 4 Set Up Group	106
4.10	Input 5 Set Up Group	108
4.11	Control Set Up Group	111
4.12	Control 2 Set Up Group	116
4.13	Options Set Up Group	120
4.14	Communications Set Up Group	128
4.15	Alarms Set Up Group	133
4.16	Display Set Up Group	138
4.17	Calibration Data	141
4.18	Status Test Data	141

ATTENTION If you are replacing a UDC6000 or an existing UDC6300 you can keep the old configuration data by removing the EEPROM from the old unit and placing it in the new unit. Refer to Subsection 8.8 for location of the EEPROM and instructions.

4.2 Tuning Parameters Set Up Group

Introduction

Tuning consists of establishing the appropriate values for the tuning constants for a single loop controller. These parameters are also for Loop 1 of a 2 Loop or Cascade control configuration.
Adaptive Tune feature automatically selects Gain, Rate, and Reset.
This section also contains Keyboard Lockout/Security selections.

Set this group last

Because this group contains functions that have to do with security and lockout, we recommend that you configure this group last, after all the other configuration data has been loaded.

Tuning group prompts

Table 4-1 lists all the function prompts in the Tuning setup group and their definitions.

Table 4-1 Tuning Group Prompt Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PROP BD or **GAIN**	0.1 to 9999% or 0.001 to 1000	**PROPORTIONAL BAND** (simplex) is the percent of the range of the measured variable for which a proportional controller will produce a 100% change in its output. **GAIN** is the ratio of output change (%) over the measured variable change (%) that caused it. $G = \frac{100\%}{PB\%}$ where PB is the proportional band (in %) If the PB is 20%, then the Gain is 5. And, at those settings, a 3% change in the error signal (SP-PV) will result in a 15% change in the controller's output due to proportional action. If the Gain is 2, then the PB is 50%. Also defined as "HEAT" Gain on Duplex models for variations of Heat/Cool applications. The selection of Prop. Band or Gain is made in the "CONTROL" parameter group under prompt "PBorGAIN."
GAIN VALn	Read Only	**LOOP 1 GAIN** - This is the value being provided by **Gain Scheduling** when enabled.
RATE MIN	0.00 to 10.00 minutes 0.08 or less = OFF	**RATE** action, in minutes, affects the controller's output whenever the deviation is changing; and affects it more when the deviation is changing faster. Also defined as "HEAT" Rate on Duplex models for variations of Heat/Cool applications.

Table 4-1 continued on next page

Table 4-1 Tuning Group Prompt Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
RSET MIN or **RSET RPM**	0.02 to 50.00	**RSET MIN** = RESET IN MINUTES / REPEAT **RSET RPM** = RESET IN REPEATS PER MINUTE **RESET** (Integral Time) adjusts the controller's output in accordance with both the size of the deviation (SP-PV) and the time it lasts. The amount of the corrective action depends on the value of Gain. The Reset adjustment is measured as how many times proportional action is repeated/minute or how many minutes before one repeat of the proportional action occurs. Used with control algorithm PID-A or PID-B. Also defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications. The selection of minutes per repeat or repeats per minute is made in the “CONTROL” parameters group under prompt "MINorRPM."
MAN RSET	–100 to +100 (in % output)	**MANUAL RESET** is only applicable if you use control algorithm PD WITH MANUAL RESET in the “Algorithm” Set up group.. Because a proportional controller will not necessarily line out at setpoint, there will be a deviation (offset) from setpoint. This eliminates the offset and lets the PV line out at setpoint. Bias appears on the lower display.
PROP BD2 or **GAIN 2**	0.1 to 999.9% or 0.001 to 999.9	**PROPORTIONAL BAND 2** or **GAIN 2**, **RATE 2**, and **RESET 2** parameters are the same as previously described for “Heat” except that they refer to the **cool** zone tuning constants on duplex models or the second set of PID constants, whichever is pertinent. **ATTENTION** Set 2 Tuning Parameters are not available when Adaptive Tune selection for Loop 1 is “SP+PV”.
RATE2MIN	0.00 to 10.00 minutes 0.08 or less = OFF	
RSET2MIN **RSET2RPM**	0.02 to 50.00	
GAIN VALn	Read Only	**LOOP 2 GAIN** - This is the value being provided by Gain Scheduling.
CYCLE SEC	1 to 120 seconds	**CYCLE TIME (HEAT)** determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications.
CYC2 SEC	1 to 120 seconds	**CYCLE TIME 2 (COOL)** is the same as above except it applies to Duplex models as the cycle time in the "COOL" zone of Heat/Cool applications or for 2nd set of PID constants.

Table 4-1 continued on next page

Table 4-1 Tuning Group Prompt Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SECURITY	0000-4095	**SECURITY CODE** – The level of keyboard lockout may be changed in the set up mode. Knowledge of a security code may be required to change from one level to another. Select this number here, copy it, and keep it in a secure location. Entering "0" disables the security code feature. NOTE: The Security Code is for keyboard entry only and is not available via communications. Can only be changed if "LOCKOUT" selection is "NONE".
LOCKOUT		**LOCKOUT** applies to one of the functional groups: Configuration, Calibration, Tuning, Adaptive Tune. **DO NOT CONFIGURE UNTIL ALL CONFIGURATION IS COMPLETE.**
	NONE	No Lockout – all groups read/write.
	CALIBRATE	**CALIB RATE**– All are available for read/write except for the Calibration.
	+CONF	**+CONF** – Tuning, SP Ramp, and Adaptive Tune groups are read/write. All other groups are read only. Calibration group is not available.
	+VIEW	**+VIEW** – Tuning and Setpoint Ramp parameters are read/write. No other parameters are viewable.
	MAXIMUM	**MAX IMUM**– Tuning and Setpoint Ramp parameters are available for read only. No other parameters are available.
PVEU VAL 1 **PVEU VAL 2** **PVEU VAL 3** **PVEU VAL 4** **PVEU VAL 5** **PVEU VAL 6** **PVEU VAL 7** **PVEU VAL 8**	PV1 Value for Gain Scheduling PV2 Value for Gain Scheduling PV3 Value for Gain Scheduling PV4 Value for Gain Scheduling PV5 Value for Gain Scheduling PV6 Value for Gain Scheduling PV7 Value for Gain Scheduling PV8 Value for Gain Scheduling	Gain Scheduling allows you to schedule 8 user-defined Gain Values (GAIN VALn) applied over 8 user-defined PV Bands (PVEU VALn). **PVEU VAL 1** is the first PV value to be used in the schedule. Enter a value, in engineering units, that is within the PV limits. To complete the PV selections for the segments, enter a PV value for all the PVEU VAL prompts listed. The table on the next page shows the relationship between the GAIN Values and the PVEU Values.

Table 4-1 continued on next page

Table 4-1 Tuning Group Prompt Definitions, continued

<table>
<tr><th>Lower Display Prompt</th><th>Upper Display Range of Setting or Selection</th><th>Parameter Definition</th></tr>
<tr><td>GAIN VAL 1</td><td>Gain Value 1 for Gain Scheduling</td><td rowspan="8">GAIN VAL 1 is the first of 8 user-defined Gain values.

Enter a Gain Value you want to be used with "PVEU VAL n" previously entered.

To complete the Gain selections, enter a Gain value for all the GAIN VAL prompts listed.

The table below shows the relationship between the GAIN Values and the PVEU Values.
<table>
<tr><th>Gain Value X</th><th>PV Band over which each Gain applies</th></tr>
<tr><td>1</td><td>Low range limit to PVEU VAL2</td></tr>
<tr><td>2</td><td>PVUE VAL2 to PVEU VAL3</td></tr>
<tr><td>3</td><td>PVUE VAL3 to PVEU VAL4</td></tr>
<tr><td>4</td><td>PVUE VAL4 to PVEU VAL5</td></tr>
<tr><td>5</td><td>PVUE VAL5 to PVEU VAL6</td></tr>
<tr><td>6</td><td>PVUE VAL6 to PVEU VAL7</td></tr>
<tr><td>7</td><td>PVUE VAL7 to PVEU VAL8</td></tr>
<tr><td>8</td><td>PVUE VAL8 to High Range Limit</td></tr>
</table>
ATTENTION When PB is configured (instead of Gain) in the "CONTROL" group prompt "PB or GAIN", the displayed "GAIN VALn" is in units of %PB.</td></tr>
<tr><td>GAIN VAL 2</td><td>Gain Value 1 for Gain Scheduling</td></tr>
<tr><td>GAIN VAL 3</td><td>Gain Value 1 for Gain Scheduling</td></tr>
<tr><td>GAIN VAL 4</td><td>Gain Value 1 for Gain Scheduling</td></tr>
<tr><td>GAIN VAL 5</td><td>Gain Value 1 for Gain Scheduling</td></tr>
<tr><td>GAIN VAL 6</td><td>Gain Value 1 for Gain Scheduling</td></tr>
<tr><td>GAIN VAL 7</td><td>Gain Value 1 for Gain Scheduling</td></tr>
<tr><td>GAIN VAL 8</td><td>Gain Value 1 for Gain Scheduling</td></tr>
</table>

4.3 Tuning Loop 2 Parameters Set Up Group

Introduction

Tuning L2 (Loop 2) consists of establishing the appropriate values for the tuning constants for Loop 2 on 2 Loops or Internal Cascade control.

Tuning group prompts

Table 4-2 lists all the function prompts in the Tuning L2 setup group and their definitions.

Table 4-2 Tuning L2 (Loop 2) Group Prompt Definitions

<table>
<tr><th>Lower Display Prompt</th><th>Upper Display Range of Setting or Selection</th><th>Parameter Definition</th></tr>
<tr><td>PROP BAND3
GAIN 3
RATE3MIN
RESET3MIN or
RESET3RPM
MANRESET3
PROP BAND4
GAIN 4
RATE4MIN
RESET4MIN or
RESET4RPM
CYC3SEC
CYC4SEC
PVEU VAL 1
PVEU VAL 2
PVEU VAL 3
PVEU VAL 4
PVEU VAL 5
PVEU VAL 6
PVEU VAL 7
PVEU VAL 8
GAIN VAL 1
GAIN VAL 2
GAIN VAL 3
GAIN VAL 4
GAIN VAL 5
GAIN VAL 6
GAIN VAL 7
GAIN VAL 8</td><td>Same as "TUNING"</td><td>The definitions listed for the parameters at the left are the same as those listed previously for the TUNING parameters Set Up Group except they are for Loop 2.

The table below shows you how to use them for Duplex Heat/Cool applications.

DUPLEX OUTPUT RANGES
0 TO 50%-TUNING SETS 2 AND 4:COOL
50 TO 100%-TUNING SETS 1 AND 3: HEAT
<table>
<tr><th>Duplex Output Range</th><th>Heat or Cool</th><th>Loop 1</th><th>Loop 2</th></tr>
<tr><td>0 to 50%</td><td>Cool</td><td><u>PID SET 2</u>
Gain 2
Rate 2
Reset 2
Cycle 2</td><td><u>PID SET 4</u>
Gain 4
Rate 4
Reset 4
Cycle 4</td></tr>
<tr><td>50 to 100%</td><td>Heat</td><td><u>PID SET 1</u>
Gain
Rate
Reset
Cycle</td><td><u>PID SET 3</u>
Gain 3
Rate 3
Reset 3
Cycle 3</td></tr>
</table>
</td></tr>
</table>

4.4 Setpoint Ramp/Rate Set Up Group

Introduction

This data deals with enabling Single Setpoint Ramp function or Setpoint Rate on one or both control loops. You can start or stop the ramp by pressing the FUNC key and the ▲ key simultaneously.

A single setpoint ramp can be configured to occur between the current local setpoint and a final local setpoint over a time interval of from 1 to 255 minutes.
There is also a configurable rate of change for any local setpoint change.

ATTENTION SPRAMP and SRRATE will probably cause the SP portion of Accutune to abort. PV Tune will function normally.

Setpoint Ramp/ Rate group prompts

Table 4-3 lists all the function prompts in the Setpoint Ramp/Rate setup group and their definitions.

Table 4-3 Setpoint Ramp/Rate Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SP RAMP		**SINGLE SETPOINT RAMP** — make a selection to enable or disable the setpoint ramp function. Make sure you configure a ramp time and a final setpoint value.
	DISABL	**DISABLE SETPOINT RAMP** — Disables the setpoint ramp option
	ENABLE	**ENABLE SETPOINT RAMP** — Allows the single setpoint ramp prompts for Loop 1 to be shown.
	ENABLE 2	**ENABLE SETPOINT RAMP** — Allows the single setpoint ramp to run in Loop 2.
	ENABLE 12	**ENABLE SETPOINT RAMP** — Allows the single setpoint ramp to be run on Loop 1 and Loop 2.
TIME MIN	0 to 255 minutes	**SETPOINT RAMP TIME** — Enter the number of minutes desired to reach the final setpoint. A ramp time of “0” implies and immediate change of setpoint.
FINAL SP	Within SP limits	**SETPOINT RAMP FINAL SETPOINT** — Enter the value desired for the final setpoint. The controller will operate at the setpoint set here when ramp is ended. **ATTENTION** If the ramp is on "HOLD", the held setpoint can be changed by the ▲ or ▼ keys. However, the ramp time remaining and original ramp rate is not changed. Therefore, when returning to RUN mode, the setpoint will ramp at the same rate as previous to the local setpoint change and will stop if the final setpoint is reached before the time expires. If the time expires before the final setpoint is reached, it will jump to the final setpoint. **ATTENTION** SP RAMP and SP RATE will cause the SP portion of Accutune to abort. PV Tune will continue to function normally.

Table 4-3 continued on next page

Setpoint Ramp/ Rate group prompts, continued

Table 4-3 Setpoint Ramp/Rate Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SP RATE	 DISABL ENABLE ENABLE 2 ENABLE 12	**SETPOINT RATE** — Lets you configure a specific rate of change for any local setpoint change. "SP RAMP" must be disabled. **DISABLE SETPOINT RATE** — disables the setpoint rate option **ENABLE SETPOINT RATE** — allows the SP rate feature for Loop 1 **ENABLE SETPOINT RATE 2** — allows the SP rate feature for Loop 2 **ENABLE SETPOINT RATE 12** — allows the SP rate feature for Loop 1 and Loop 2.
EU/HR UP	0 to 9999 in Engineering Units per hour	**RATE UP** — Rate up value for Loop 1. When making a setpoint change, this is the rate at which the controller will change from the original setpoint up to the new one. The ramping (current) setpoint can be viewed as SPn in the lower display. Entering a 0 will imply an immediate change in Setpoint (i.e. no rate applies).
EU/HR DN	0 to 9999 in Engineering Units per hour	**RATE DOWN** — Rate down value for Loop 1. When making a setpoint change, this is the rate at which the controller will change from the original setpoint down to the new one. The ramping (current) setpoint can be viewed as SPn in the lower display. Entering a 0 will imply an immediate change in Setpoint (i.e. no rate applies).
EU/HR UP2	0 to 9999 in Engineering Units per hour	**RATE UP** — Rate up value for Loop 2. When making a setpoint change, this is the rate at which the controller will change from the original setpoint up to the new one. The ramping (current) setpoint can be viewed as SPn in the lower display. Entering a 0 will imply an immediate change in Setpoint (i.e. no rate applies).
EU/HR DN 2	0 to 9999 in Engineering Units per hour	**RATE DOWN** — Rate down value for Loop 2. When making a setpoint change, this is the rate at which the controller will change from the original setpoint down to the new one. The ramping (current) setpoint can be viewed as SPn in the lower display. Entering a 0 will imply an immediate change in Setpoint (i.e. no rate applies).

4.5 Accutune Set Up Group

Introduction

Accutune offers the following selections:

- (FUZZY) Fuzzy Overshoot Suppression
- (TUNE)Demand Tuning, or
- (SP Only) Setpoint Tuning, or
- (TUNE+PV) Demand Tuning + PV Adaptive Tune
- (SP+PV) Setpoint Tuning + PV Adaptive Tune

Descriptions of their functions are listed with each selection in Table 4-4.

ATTENTION Selecting "**Gain Scheduling**" in the "CONTROL" or "CONTROL 2" Set Up groups automatically disables Accutune for that group.

Accutune group prompts

Table 4-4 lists all the function prompts in the Accutune setup group and their definitions.

Table 4-4 Accutune Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
FUZZY		**FUZZY OVERSHOOT SUPPRESSION -** can be enabled or disabled independently of whether Demand tuning or SP tuning is enabled or disabled.
	DISABL	**DISABLE-** Disable Fuzzy Overshoot Suppression
	ENABLE	**ENABLE** - The UDC uses Fuzzy Logic to suppress or minimize any overshoot that may occur when PV approaches SP. It will not recalculate any new tuning parameters.
ACCUTUNE		**ACCUTUNE**
	DISABL	**DISABLE** – Disables the Accutune function.
	TUNE	**TUNE** - If “TUNE” is selected, and tuning is initiated through the operator interface or digital input (if configured), the algorithm calculates new tuning parameters and enters them into the tuning group.
	SP Only	**SETPOINT ONLY** – This selection tunes on setpoint changes only. It employs time domain analysis to accelerate line out at any desired setpoint without prior process knowledge.
	TUNE+PV	**TUNE + PV** - This selection provides “TUNE” On Demand tuning Plus PV adaptive tuning whenever a PV process disturbance of 0.3% span or greater occurs. It will take 1 and 1/2 process cycles around setpoint befor any process recognition and re-tuning can occur due to PV disturbances.
	SP Only + PV *(**SP Only and SP+PV** do not operate with TPSC Algorithm)*	**SP + PV** - This selection tunes on setpoint changes but also whenever a PV process disturbance of 0.3% span or greater occurs. It will take 1 and 1/2 process cycles around setpoint befor any process recognition and re-tuning can occur due to PV disturbances.

Table 4-4 continued on next page

Table 4-4 Accutune Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
ACCUTUNE 2	 DISABL TUNE SPoNLY TUNE + PV SP Only + PV	**ACCUTUNE - Loop 2** Available only if configured for 2Loop or Cascade. **DISABLE ACCUTUNE 2** – Disables the Accutune function for Loop 2. **TUNE** - same as ACCUTUNE **SETPOINT ONLY** – Same as ACCUTUNE **TUNE + PROCESS VARIABLE**- Same as ACCUTUNE **SETPOINT ONLY PLUS PROCESS VARIABLE** - Same as ACCUTUNE
SP CHANG*	5 to 15%	**SETPOINT CHANGE -** The minimum setpoint change that will result in re-tuning must be configured between 5% and 15%:(i.e. If the range is 0 to 2400 and 5% is configured, re-tuning will occur if the setpoint change is 120 or larger.)
PROC GAIN*	0.10 to 10.00	**PROCESS GAIN** – This is the Gain of the process being tuned on Loop 1. It is automatically calculated during tuning process. This is normally a READ only value. It should only need to be changed if the cont-roller fails to identify the process. In this case, set the value to the algebraic value of PV in percent, divided by output in percent while in the manual mode.
SP CHANG2*	5 to 15%	**SETPOINT CHANGE LOOP 2-** The minimum setpoint change on Loop 2 that will result in re-tuning must be configured between 5% and 15%:
PROC GAIN 2*	0.10 to 10.00	**PROCESS GAIN LOOP 2** – This is the Gain of the process being tuned on Loop 2. It is automatically calculated during tuning process. This is normally a READ only value. It should only need to be changed if the controller fails to identify the process. In this case, set the value to the algebraic value of PV in percent, divided by output in percent while in the manual mode. **ATTENTION** Note you must disable Accutune to change tuning constant values from the keyboard.
CRITERIA*	 **NORMAL** **FAST**	**TUNING CRITERIA (SETPOINT ADAPT) - S**elect a criteria best suited for your process on loop 1. **NORMAL** - Original critical damping (no overshoot) **FAST** - a more aggressive tuning with a minimal possible overshoot of less than 0.5%.

* Applies to “SP Only” and “SP+PV” tuning only

Continued on next page

Table 4-4 Accutune Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CRITERIA2*	 **NORMAL** **FAST**	**TUNING CRITERIA FOR LOOP 2 (SETPOINT ADAPT) - S**elect a criteria best suited for your process on Loop 2 **NORMAL** - Original critical damping (no overshoot) **FAST** - a more aggressive tuning with a minimal possible overshoot of less than 0.5%. For Example: Slightly underdamped
AT ERROR	**See *Section 5 - Operation* for a list of error prompts.**	**ADAPTIVE TUNE ERROR STATUS LOOP1**– When an error is detected in the Accutune process, an error prompt will appear.
AT ERROR2	**See *Section 5 - Operation* for a list of error prompts.**	**ADAPTIVE TUNE ERROR STATUS LOOP 2** – When an error is detected in the Accutune process, an error prompt will appear.

* Applies to “SP Only” and “SP+PV” tuning only

4.6 Algorithm Data Set Up Group

Introduction

This data deals with various algorithms in the controller:

- Control algorithm,
- Input Math algorithms,
- Selecting the Number of PID Loops, and
- Output Override.

Algorithm group prompts

Table 4-5 lists all the function prompts in the Algorithm setup group and their definitions.

Table 4-5 Algorithm Group Definitions

<table>
<tr><th>Lower Display
Prompt</th><th>Upper Display
Range of Setting
or Selection</th><th>Parameter
Definition</th></tr>
<tr><td>LOOP RATE</td><td><u>Loop 1</u> <u>Loop 2</u>
1 12X
1 9X 2 3X
1 6X 2 3X
1 3X 2 3X</td><td>The LOOP RATE is the Loop sampling rate per second for inputs 1 through 4 and is selectable from 3 to 12 conversions per second for each loop (1 or 2). A faster sampling rate reduces the number of inputs that can be used.

Input 5 cannot be used for Loop 1 selections faster than 3X, nor for either Loop when using the
1 9X 3X selection.

The table below shows the available selections.
<table>
<tr><th>Loop Rate Selection</th><th>Loop 1</th><th>Loop 2</th><th>Maximum Number of High Level Inputs</th></tr>
<tr><td>1 12X</td><td>12X</td><td>N/A</td><td>1</td></tr>
<tr><td>1 9X 3X</td><td>9X</td><td>3X</td><td>2</td></tr>
<tr><td>1 6X 2 3X</td><td>6X</td><td>3X</td><td>3</td></tr>
<tr><td>1 3X 2 3X</td><td>3X</td><td>3X</td><td>4</td></tr>
</table></td></tr>
<tr><td>CONT ALG</td><td>

ON-OFF</td><td>The CONTROL ALGORITHM lets you select the type of control that is best for your process.

ON/OFF is the simplest control type. The output can be either ON (100%) or OFF (0%). The Process Variable (PV) is compared with the setpoint (SP) to determine the sign of the error (ERROR = PV-SP). The ON/OFF algorithm operates on the sign of the error signal.
In Direct Acting Control, when the error signal is positive, the output is 100%; and when the error signal is negative, the output is 0%. If the control action is reverse, the opposite is true. An adjustable overlap (Hysteresis Band) is provided between the on and off states.
Other prompts affected: “OUT HYST”

Continued next page</td></tr>
</table>

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CONT ALG (continued)	ON-OFF (continued)	**DUPLEX ON/OFF** is an extension of this algorithm when the output is configured for Duplex. It allows the operation of a second ON/OFF output. There is a deadband between the operating ranges of the two inputs and an adjustable overlap (hysteresis) of the on and off states of each output. Both Deadband and Hysteresis are separately adjustable. With no relay action the controller will read 50%. Other prompts affected: “OUT HYST” and “DEADBAND”
	PID A NOTE: PID A should not be used for Proportional only action. i.e. no integral (reset) action. Instead, use PD+MR with rate set to 0.	**PID A** is normally used for three-mode control. This means that the output can be adjusted somewhere between 100% and 0%. It applies all three control actions — Proportional (P), Integral (I), and Derivative (D) — to the error signal. Proportional (Gain) — regulates the controller’s output in proportion to the error signal (the difference between Process Variable and Setpoint). Integral (Reset) -- regulates the controller's output to the size of the error and the time the error has existed. (The amount of corrective action depends on the value of proportional Gain.) Derivative (Rate) -- regulates the controller's output in proportion to the rate of change of the error. (The amount of corrective action depends on the value of proportional Gain.)
	PID B	**PID B** Unlike the PID-A equation, the controller gives only an integral response to a setpoint change, with no effect on the output due to the gain or rate action, and it gives full response to PV changes. Otherwise controller action is as described for the PID-A equation. See note on PID-A.
	PD+MR	**PD WITH MANUAL RESET** is used whenever integral action is not wanted for automatic control. The equation is computed with no integral contribution. The MANUAL RESET, which is operator adjustable, is then added to the present output to form the controller output. Switching between manual and automatic mode will be bumpless. If you select PD with Manual Reset you can also configure the following variations • PD (Two Mode) control, • P (Single Mode) control. Set Rate (D) to 0. Other prompts affected: "MAN RSET" in the “Tuning” Set up group.

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CONT ALG continued	3 POS STEP	**THREE POSITION STEP** - The Three Position Step Control algorithm allows the control of a valve (or other actuator) with an electric motor. Digital Outputs 3 and 4 generate control signals that drive external relays; one to move the motor upscale, the other to move it downscale, without a feedback slidewire linked to the motor shaft. 3PSTEP is an extension of the On-Off Duplex Control and includes internal feedback of the state of the Digital Outputs. In this algorithm, the error signal is compared with a feedback signal and the result determines the state of the Digital Outputs as follows: Positive Error > Feedback Digital Output 3 On Negative Error < Feedback Digital Output 4 On Otherwise, the outputs are both off. The 3PSTEP control algorithm provides an output display (“OUT”) which is an estimated motor position since the motor is not using any *slidewire* feedback. **Select a Motor Travel Time at prompt “MTR TIME”.**
	M/A STN	**MANUAL/AUTO STATION**—Provides an operator display for the TDC PID loop PV, SP, OP and MODE. The UDC loop has only Manual control at the UDC6300. Auto mode for the loop is maintained in the TDC. If you select Auto mode at the UDC, the MAN indicator will blink, indicating AUTO is not available. When the TDC provides an output override value, MAN indicator will turn OFF. AUTO indicator is never displayed. Output override does not necessarily mean that the loop is in AUTO. *Other configuration settings required:* Setup CONTROL prompt PV SOURCE = NONE. Setup CONTROL prompts SPHILIM, SPLOLIM = PV and SP range (for bargraph). Refer to Manual/Auto Station Addendum 51-52-99-08 for implementation details.
MTR TIME (appears only if 3POS STEP is selected above)	5 to 255 in seconds	**THREE POSITION STEP MOTOR TRAVEL TIME -** this is the time it takes the motor to travel from 0% to 100% Refer to Subsection 5.21 - *Three Position Step Control* for complete configuration and operating instructions.

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PID LOOPS		**PID LOOPS** - This is the PID loop selection.
	1 LOOP	**1 LOOP** - select to use one loop of control.
	2LOOPS	**2LOOPS** - Select to use two PID loops of control, each with two sets of tuning parameters and a set of control parameters.
	CASCADE	**CASCADE** - Select for Cascade Control. Cascade control is a control system where the output of one PID loop is used to adjust the setpoint of the second control loop and the second loop's output actually adjusts the final control element. **ATTENTION** To enable a cascade loop, press the RSP/CAS key. The CAS annunciator will light to indicate cascade mode. Press again to disable .
CONT2 ALG		The **CONTROL 2 ALGORITHM** lets you select the type of control for Loop 2 that is best for your process. Only available if the controller is configured for Cascade or 2Loop. 3PStep and On/Off not available for the second control loop.
	PID A NOTE: PID A should not be used for Proportional only action. i.e. no integral (reset) action. Instead, use PD+MR with rate set to 0.	**PID A** is normally used for three-mode control. This means that the output can be adjusted somewhere between 100% and 0%. It applies all three control actions — Proportional (P), Integral (I), and Derivative (D) — to the error signal. Proportional (Gain) — regulates the controller's output in proportion to the error signal (the difference between Process Variable and Setpoint). Integral (Reset) -- regulates the controller's output to the size of the error and the time the error has existed. (The amount of corrective action depends on the value of proportional Gain.) Derivative (Rate) -- regulates the controller's output in proportion to the rate of change of the error. (The amount of corrective action depends on the value of proportional Gain.)
	PID B	**PID B** Unlike the PID-A equation, the controller gives only an integral response to a setpoint change, with no effect on the output due to the gain or rate action, and it gives full response to PV changes. Otherwise controller action is as described for the PID-A equation. See note on PID-A.

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CONT2 ALG continued	PD+MR	**PD WITH MANUAL RESET** is used whenever integral action is not wanted for automatic control. The equation is computed with no integral contribution. The MANUAL RESET, which is operator adjustable, is then added to the present output to form the controller output. Switching between manual and automatic mode will be bumpless. If you select PD with Manual Reset you can also configure the following variations • PD (Two Mode) control, • P (Single Mode) control. Set Rate (D) to 0. Other prompts affected: "MANRESET3"
	M/A STN	**MANUAL/AUTO STATION**—Provides an operator display for the TDC PID loop PV, SP, OP and MODE. The UDC loop has only Manual control at the UDC6300. Auto mode for the loop is maintained in the TDC. If you select Auto mode at the UDC, the MAN indicator will blink, indicating AUTO is not available. When the TDC provides an output override value, MAN indicator will turn OFF. AUTO indicator is never displayed. Output override does not necessarily mean that the loop is in AUTO. *Other configuration settings required:* Setup CONTROL2 prompt PV2 SRC = NONE. Setup CONTROL2 prompts SPHILIM, SPLOLIM = PV and SP range (for bargraph). Refer to Manual/Auto Station Addendum 51-52-99-08 for implementation details.
OUTOVRD		**OUTPUT OVERRIDE SELECT** - This selection lets you select high or low output override. Only available if the controller is configured for Cascade or 2Loop. **ATTENTION** Loop 1 must be in Automatic for this to work.
	DISABL	**DISABLE**s Output Override
	HI SELECT	**HIGH SELECT** - The controller will select the higher of output 1 or output 2 and direct it to output 1 rear terminals.

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
OUTOVRD continued	LO SELECT	**LOW SELECT** - The controller will select the lower of output 1 or output 2 and direct it to output 1 rear terminals. **ATTENTION** The unselected output will track the selected output within 5% to eliminate windup in the unselected direction.
INPUT MATH ALGORITHMS - The controller is provided with two input algorithms. Each algorithm can be configured to provide a derived (calculated) PV or a derived Remote setpoint. Up to three inputs may be applied to the calculation. In addition, the 2 algorithms may be "linked" to combine two calculations by configuring one algorithm to be an input to the other algorithm. See Input A, B, and C for definitions per equation. All algorithms operate in Engineering Units except Feedforward which operates in percent of range units. The Pulse input is calculated in percent of full scale.		
IN ALG 1		**INPUT ALGORITHM 1** has the following selections from which to choose:
	NONE	**NONE** - No algorithm configured
	WTD AVG	**WEIGHTED AVERAGE** - When you configure for Weighted Average, the controller will compute a PV or SP for the control algorithm from the following equation: $\text{PV or SP} = \frac{(\text{Input A x Ratio A + Bias A}) + \text{K(Input B x Ratio B + Bias B)}}{(1 + K)}$ Both Inputs must have the same range in engineering units.
	FFWD SUM	**FEEDFORWARD SUMMER** - Feedforward uses Input A, following a Ratio and Bias calculation as a value summed directly with the PID computed output value and sent, as an output value, to the final control element. Applies to Loop 1 only. This algorithm will only function in automatic mode. The following formula applies: Controller Output = PID Output + (Input A x Ratio A + BiasA)

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
IN ALG 1 continued		**INPUT ALGORITHM 1** (continued)
	SUMMER	**SUMMER WITH RATIO AND BIAS -** The following formula applies:
	PV (or SP) = (Input A x RatioA + Bias A) + (Input B x RatioB + BiasB)+ (Input C x RatioC + BiasC)	
	HI SELECT	**INPUT HIGH SELECT WITH RATIO AND BIAS -** This selection specifies the PV or SP as the higher of Input 1 or Input 2. The following formula applies:
		PV (or SP) = higher of (Input A x RatioA + BiasA) or (Input B x RatioB + BiasB)
	LO SELECT	**INPUT LOW SELECT WITH RATIO AND BIAS -** This selection specifies the PV or SP as the lower of Input 1 or Input 2. The following formula applies:
		PV (or SP) =lower of (Input A x RatioA + BiasA) or (Input B x RatioB + BiasB)
	√ MUL DIV (note 1)	**MULTIPLIER DIVIDER WITH SQUARE ROOT** - The following formula applies:
	$$\text{PV (or RSP)} = K \times \sqrt{\frac{(\text{Input A} \times \text{RatioA} + \text{BiasA}) \times (\text{Input C} \times \text{RatioC} + \text{BiasC})}{(\text{Input B} \times \text{RatioB} + \text{BiasB})}} \quad X\ (\text{Calc HI} - \text{Calc}_{LO})$$	
	See Figure 4-1 at the end of this section for an example of Mass Flow Compensation using Multiplier/Divider Algorithm	
	√ MULTIPLY (note 1)	**MULTIPLIER WITH SQUARE ROOT** - The following formula applies:
$$\text{PV (or RSP)} = K \times \sqrt{(\text{Input A} \times \text{RatioA} + \text{BiasA}) \times (\text{Input C} \times \text{Ratio C} + \text{BiasC}) \times (\text{Input B} \times \text{RatioB} + \text{BiasB})}\ X\ (\text{Calc HI} - \text{CalcLO})$$		
	MULT DIV	**MULTIPLIER DIVIDER** - The following formula applies:
	$$\text{PV (or RSP)} = K \times \frac{(\text{Input A} \times \text{RatioA} + \text{BiasA}) \times (\text{Input C} \times \text{RatioC} + \text{BiasC})}{(\text{Input B} \times \text{RatioB} + \text{BiasB})} \quad X\ (\text{Calc HI} - \text{Calc}_{LO})$$	
	MULTIPLY	**MULTIPLIER** - The following formula applies:
$$\text{PV (or RSP)} = K \times (\text{Input A} \times \text{RatioA} + \text{BiasA}) \times (\text{Input C} \times \text{RatioC} + \text{BiasC}) \times (\text{Input B} \times \text{RatioB} + \text{BiasB})\ X\ (\text{CalcHI} - \text{CalcLO})$$		
	Where: K = 0.001 to 1000 (configurable) Calc Hi and Calc Lo are configurable over a range of –999 to 9999	

Note 1. If the calculated value of the quantity under the square root sign decreases to a value less than 0.010, the calculation will become linear as the calculated value decreases below 0.010.

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
IN ALG 1 (continued)	 FFWD MULT	**INPUT ALGORITHM 1** (continued) **FEEDFORWARD MULTIPLIER -** applies to Loop 1 only and uses Input A, following a Ratio and Bias calculation as a value multiplied by the PID computed output value and sent, as an output value, to the final control element. This algorithm will only function in automatic mode. Controller Output = PID Output x (Input A x Ratio $_A$+ Bias$_A$)
CONSTNT K	0.001 to 1000	**WEIGHTED AVERAGE RATIO OR K CONSTANT FOR MATH SELECTIONS -** Only applicable for algorithms "WTD AVG" or Math selections "√ MUL DIV ", √ MULTIPLY ", "MULT DIV", or "MULTIPLY"
CALC HIGH	–999 to 9999	**CALCULATED VARIABLE HIGH SCALING FACTOR FOR INPUT ALGORITHM 1 -** Does not apply to Feedforward Algorithms.
CALC LOW	–999 to 9999	**CALCULATED VARIABLE LOW SCALING FACTOR FOR INPUT ALGORITHM 1 -** Does not apply to Feedforward Algorithms.
ALG 1 IN A	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG OUTPUT 1 OUTPUT 2	**ALGORITHM 1, INPUT A SELECTION -** will represent one of the available selections **OTHER ALG** - Algorithm 1 is performed before Algorithm 2. If ALG2 is used in ALG1, there is a one cycle delay
ALG 1 IN B	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG OUTPUT 1 OUTPUT 2	**ALGORITHM 1, INPUT B SELECTION -** will represent one of the available selections **OTHER ALG** - Algorithm 1 is performed before Algorithm 2. If ALG2 is used in ALG1, there is a one cycle delay
ALG 1 IN C	NONE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG	**ALGORITHM 1, INPUT C SELECTION -** will represent one of the available selections

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
IN ALG 2	NONE WTD AVG FFWD SUM2*(applies only to Loop 2)* A–B DIV C * HI SELECT LO SELECT √ MUL DIV √ MULTIPLY MUL DIV MULTIPLY FFWD MUL2*(applies only to Loop 2)*	**INPUT ALGORITHM 2 -** the selections from which to choose are listed to the left. The formulas are the same as shown for **"IN ALG 1"**. * **ATTENTION** Selection "**A–B DIV C**" algorithm subtracts Input B with Ratio/Bias from Input A with Ratio/Bias and divides the result by Input C with Ratio/Bias using Engineering units. Example $\text{PV or SP} = K\frac{(A - B)}{C}\ (\text{Calc Hi - Calc Lo}))$
CONST K2	0.001 to 1000	**WEIGHTED AVERAGE RATIO OR K CONSTANT FOR MATH SELECTIONS -** Only applicable for algorithms "WTD AVG" or Math selections "√ MUL DIV ", "√ MULTIPLY ", "MULT DIV", or "MULTIPLY"
CALC HIGH	–999 to 9999	**CALCULATED VARIABLE HIGH SCALING FACTOR FOR INPUT ALGORITHM 2-** Does not apply to Feedforward Algorithms.
CALC LOw	–999 to 9999	**CALCULATED VARIABLE LOW SCALING FACTOR FOR INPUT ALGORITHM 2 -** Does not apply to Feedforward Algorithms.
ALG 2 IN A	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OUTPUT 1 OUTPUT 2 OTHER ALG	**ALGORITHM 2, INPUT A SELECTION -** will represent one of the available selections.
ALG 2 IN B	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OUTPUT 1 OUTPUT 2 OTHER ALG	**ALGORITHM 2, INPUT B SELECTION -** will represent one of the available selections.
ALG 2 IN C	NONE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 OTHER ALG	**ALGORITHM 2, INPUT C SELECTION -** will represent one of the available selections.

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
8 SG CHAR1	DISABLE INPUT 2 LOOP 1 OUT LOOP 2 OUT INPUT4 *Note: The X values below should be entered as increasing values (from 0% to 100%) from N=0 to 8*	**8 SEGMENT CHARACTERIZER #1-** An eight segment characterizer can be applied to either Input 2, Output 1, Output 2, or Input 4. **DISABLE** - disables characterizer **INPUT 2** - characterizer applied to Input 2 **LOOP 1 OUT** - characterizer applied to Loop 1 Output **LOOP 2 OUT** - characterizer applied to Loop 2 Output **INPUT 4** - characterizer applied to Input 4. There are 8 (Xn) Input values and 8 (Yn) Output values to be selected. The following rules apply: • When Input 2 is used, Input 2 Ratio and Bias are applied to the Xn Values. • When one of the Loop outputs are selected, the Xn Input values are the Output from the control algorithm, and the Yn Output is the final control element action. This application is useful for non-linear control elements or Process Variable. **A simple example is shown in Figure 4-2.**
X0 VALUE	0.00 to 99.99%	**X0 INPUT VALUE (X AXIS)**
X1 VALUE	0.00 to 99.99%	**X1 INPUT VALUE (X AXIS)**
X2 VALUE	0.00 to 99.99%	**X2 INPUT VALUE (X AXIS)**
X3 VALUE	0.00 to 99.99%	**X3 INPUT VALUE (X AXIS)**
X4 VALUE	0.00 to 99.99%	**X4 INPUT VALUE (X AXIS)**
X5 VALUE	0.00 to 99.99%	**X5 INPUT VALUE (X AXIS)**
X6 VALUE	0.00 to 99.99%	**X6 INPUT VALUE (X AXIS)**
X7 VALUE	0.00 to 99.99%	**X7 INPUT VALUE (X AXIS)**
X8 VALUE	0.00 to 99.99%	**X8 INPUT VALUE (X AXIS)**
Y0 VALUE	0.00 to 99.99%	**Y0 INPUT VALUE (Y AXIS)**
Y1 VALUE	0.00 to 99.99%	**Y1 INPUT VALUE (Y AXIS)**
Y2 VALUE	0.00 to 99.99%	**Y2 INPUT VALUE (Y AXIS)**
Y3 VALUE	0.00 to 99.99%	**Y3 INPUT VALUE (Y AXIS)**
Y4 VALUE	0.00 to 99.99%	**Y4 INPUT VALUE (Y AXIS)**
Y5 VALUE	0.00 to 99.99%	**Y5 INPUT VALUE (Y AXIS)**
Y6 VALUE	0.00 to 99.99%	**Y6 INPUT VALUE (Y AXIS)**
Y7 VALUE	0.00 to 99.99%	**Y7 INPUT VALUE (Y AXIS)**
Y8 VALUE	0.00 to 99.99%	**Y8 INPUT VALUE (Y AXIS)**

Continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
8 SG CHAR2	DISABLE INPUT 2 LOOP 1 OUT LOOP 2 OUT INPUT4 *Note: The X values below should be entered as increasing values (from 0% to 100%) from N=0 to 8*	**8 SEGMENT CHARACTERIZER #2 -** A second eight segment characterizer can be applied to either Input 2, Output 1, Output 2, or Input 4. **DISABLE** - disables characterizer **INPUT 2** - characterizer applied to Input 2 **LOOP 1 OUT** - characterizer applied to Loop 1 Output **LOOP 2 OUT** - characterizer applied to Loop 2 Output **INPUT 4** - characterizer applied to Input 4. There are 8 (Xn) Input values and 8 (Yn) Output values to be selected. The following rules apply: • When Input 2 is used, Input 2 Ratio and Bias are applied to the Xn Values. • When one of the Loop outputs are selected, the Xn Input values are the Output from the control algorithm, and the Yn Output is the final control element action. This application is useful for non-linear control elements or Process Variable. **A simple example is shown in Figure 4-2.**
X0 VALUE2	0.00 to 99.99%	**X0 INPUT VALUE (X AXIS)**
X1 VALUE2	0.00 to 99.99%	**X1 INPUT VALUE (X AXIS)**
X2 VALUE2	0.00 to 99.99%	**X2 INPUT VALUE (X AXIS)**
X3 VALUE2	0.00 to 99.99%	**X3 INPUT VALUE (X AXIS)**
X4 VALUE2	0.00 to 99.99%	**X4 INPUT VALUE (X AXIS)**
X5 VALUE2	0.00 to 99.99%	**X5 INPUT VALUE (X AXIS)**
X6 VALUE2	0.00 to 99.99%	**X6 INPUT VALUE (X AXIS)**
X7 VALUE2	0.00 to 99.99%	**X7 INPUT VALUE (X AXIS)**
X8 VALUE2	0.00 to 99.99%	**X8 INPUT VALUE (X AXIS)**
Y0 VALUE2	0.00 to 99.99%	**Y0 INPUT VALUE (Y AXIS)**
Y1 VALUE2	0.00 to 99.99%	**Y1 INPUT VALUE (Y AXIS)**
Y2 VALUE2	0.00 to 99.99%	**Y2 INPUT VALUE (Y AXIS)**
Y3 VALUE2	0.00 to 99.99%	**Y3 INPUT VALUE (Y AXIS)**
Y4 VALUE2	0.00 to 99.99%	**Y4 INPUT VALUE (Y AXIS)**
Y5 VALUE2	0.00 to 99.99%	**Y5 INPUT VALUE (Y AXIS)**
Y6 VALUE2	0.00 to 99.99%	**Y6 INPUT VALUE (Y AXIS)**
Y7 VALUE2	0.00 to 99.99%	**Y7 INPUT VALUE (Y AXIS)**
Y8 VALUE2	0.00 to 99.99%	**Y8 INPUT VALUE (Y AXIS)**

Continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
POLY NOM	DISABLE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5	**POLYNOMIAL EQUATION -** A fifth order Polynomial Equation can be used on any one of the five Analog Inputs. The equation is in the form: $Y = C_5 * 10^{-7} X^5 + C_4 * 10^{-5} X^4 + C_3 * 10^{-3} X^3 + C_2 * 10^{-1} X^2 + C_1 X + C_0$ Where: X is the analog input selected in % of span $X\% = \frac{X_{EU}}{Span_{EU}} \bullet 100$ C_0 is a value between –99.99 to +99.99 C_1 - C_5 are values between –9.999 to +9.999 Ratio and Bias can be applied on the "Y" output term as follows: Calculated "Y" Value =Y * Input x Ratio + InputX Bias Where: "X" refers to the analog input (in % of span)being used and the range assigned to the "X" input chosen applies to the "Y" calculated value. After the Polynomial is enabled, refer to the prompts listed below and enter the coefficients.
C0 VALUE	–99.99 to 99.99	**POLYNOMIAL COEFFICIENT C0**
C1 VALUE	–9.999 to 9.999	**POLYNOMIAL COEFFICIENT C1**
C2 X 10 $^{-1}$	–9.999 to 9.999	**POLYNOMIAL COEFFICIENT C2**
C3 X 10 $^{-3}$	–9.999 to 9.999	**POLYNOMIAL COEFFICIENT C3**
C4 X 10 $^{-5}$	–9.999 to 9.999	**POLYNOMIAL COEFFICIENT C4**
C5 X 10 $^{-7}$	–9.999 to 9.999	**POLYNOMIAL COEFFICIENT C5**

Table 4-5 continued on next page

Table 4-5 Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
TOTALIZER	 DISABLE INPUT 1 IN ALG 1 IN ALG 2	**TOTALIZER FUNCTION-** calculates and displays the total flow volume as measured by Input 1 or applied to either Input Algorithm 1 or Algorithm 2 to totalize the compensated flow rate being calculated by the algorithm. Displayed value is eight digits with a configurable scale factor. **DISABLE** - disables the totalizer function **INPUT 1** - totalizer applied to Input 1 **IN ALG 1** - totalizer applied to Input Algorithm 1 **IN ALG 2** - totalizer applied to Input Algorithm 2 **ATTENTION** The totalizer should always be reset to initialize the counters whenever it is enabled. Otherwise, the "Σ **(sigma)** display will blink.
Σ XXXXXXXX	Σ * En	**READ ONLY** Current Scale Factor (Upper Display) Actual Current Totalized Value (Lower Display)
TOT SCALE	* E0=1 X 10^0 = 1 * E1=1 X 10^1 = 10 * E2=1 X 10^2 = 100 * E3=1 X 10^3 = 1,000 * E4=1 X 10^4 = 10,000 * E5=1 X 10^5 = 100,000 * E6=1 X 10^6 = 1,000,000	**TOTALIZER SCALE FACTOR -** selects the desired Scale Factor (i.e. Multiplier) The desired factor is applied to the calculated value to extend the maximum flow range that can be displayed.
TOT SECUR	 UNLOC LOCK	**TOTALIZER RESET LOCK -** allows the totalizer to be reset. **UNLOC** - allows the totalizer value to be reset. **LOCK** - prevents the totalizer value from being reset.
Σ RESET	 NO YES	**TOTALIZER RESET -** appears only if the totalizer is unlocked **NO** - No Reset **YES** - Resets on next FUNC key press and displays the reset value.
TOT RATE	 SECOND MINUTE HOUR DAY MIL/DAY	**TOTALIZER RATE OF INTEGRATION -** five integration rates are available to match the totalizer rate to the rate of flow being totalized. **SECOND** - EU (Engineering Units) per second **MINUTE** - EU per minute **HOUR** - EU per hour **DAY** - EU per day **MIL/DAY** - millions of units per day

Table 4-5 continued on next page

Figure 4-1 Example of Mass Flow Compensation using Multiplier/Divider Algorithm

Example - Mass Flow Compensation

A gas flow rate of 650 SCFM develops a differential pressure of 90" H_2O across an orifice plate at reference conditions of 30 psig and 140 °F. Compensate this gas flow for temperature and pressure variations.

$$\text{Flow} = K\sqrt{\frac{DP_f \times P_f}{T_f} \times \frac{T_{ref}}{P_{ref}}}$$

Where:
f = flowing conditions
ref = reference conditions (in absolute units)

Apply Multiplier/Divider Algorithm:

$$PV = K\sqrt{\frac{(\text{Input A} \times \text{Ratio}_A + \text{Bias}_A) \times (\text{Input C} \times \text{Ratio}_C + \text{Bias}_C)}{(\text{Input B} \times \text{Ratio}_B + \text{Bias}_B)}} \times (\text{Calc}_{HI} - \text{Calc}_{LO})$$

Assign inputs using Engineering units:

Let:

Input A = DP_f = IN1 (in H_2O)
Input B = T_f = IN2 + Bias2 = IN2 °F + 460 (°R)
Input C = P_f = IN3 + Bias3 = IN3psig + 14.7(psia)
T_{ref} = 140 °F + 460 = 600 °R
P_{ref} = 30 psig + 14.7 = 44.7 psia
Calc_{Hi} = 650.0
Calc_{Lo} = 0.0
Flow in SFCM at Reference Conditions
K = to be determined next

Note: If temperature and pressure signals are already ranged in absolute units, no Bias is required for inputs B and C.

$$PV = Q_{SCFM} = \sqrt{\frac{DP_f \times (IN3 + 14.7)}{(IN2 + 460)} \times K^2} \times (650.0 - 0.0)$$

Note: When IN2 and IN3 are at the reference conditions of 600°R (140°F) and 44.7psia (30 psig) respectively and DP_f = 90" H_2O, the equation must calculate 650 SCFM. To accomplish this, divide the DP value by "90" to normalize the equation.

$$Q_{SCFM} = \sqrt{\frac{DP_f}{90} \times \frac{(IN3 + 14.7)}{(IN2 + 460)} \times \frac{T_{ref}}{P_{ref}}} \times 650$$

Rearranging terms:

$$Q_{SCFM} = \sqrt{\underbrace{DP_f \times \frac{(IN3 + 14.7)}{(IN2 + 460)}}_{\textit{Variable}} \times \underbrace{\frac{1}{90} \times \frac{T_{ref}}{P_{ref}}}_{\textit{Constant} = K^2}} \times 650$$

22049

Example continued on next page

Continued on next page

Figure 4-1 Example of Mass Flow Compensation using Multiplier/Divider Algorithm, continued

Example - Mass Flow Compensation

Determined value of K:

$$K^2 = \frac{1}{90} \times \frac{T_{ref}}{P_{ref}} = \frac{600}{(90)(44.7)} = 0.14914$$

Therefore K = 0.386

$$Q_{SCFM} = \underbrace{(0.386)}_{\boxed{K}}\ \underbrace{(650)}_{\boxed{(Calc_{HI} - Calc_{LO})}} \sqrt{\frac{DP_f \text{ (in } H_2O\text{) (IN3 + 14.7)}}{\text{(IN2 + 460)}}}$$

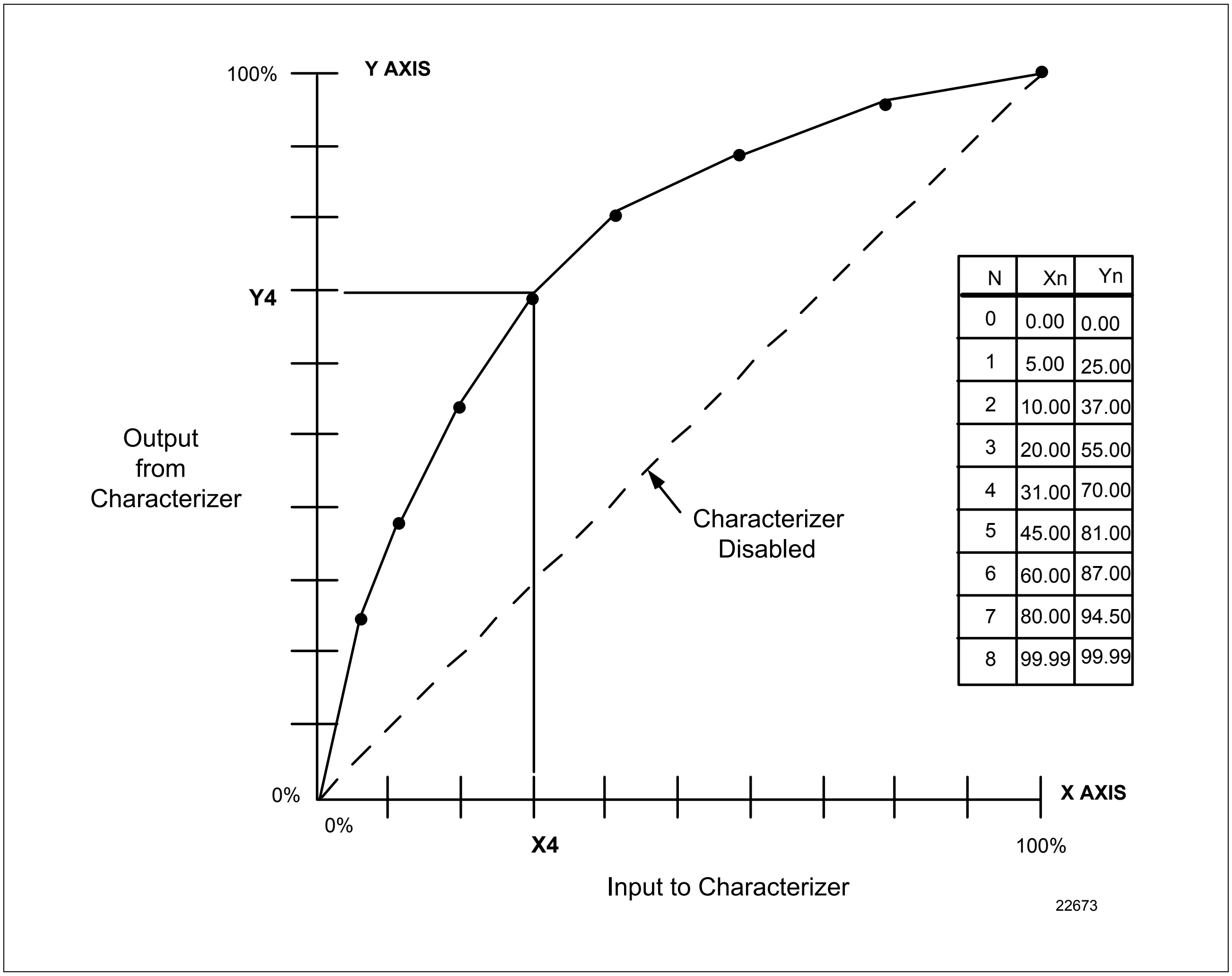
Summary of Flow Values At Values Conditions

	Temp (T_f) (°R)	Pressure (T_f) (psia)	Flow (SFCM)	
			DP_f = 45" H_2O (50%)	DP_f = 90" H_2O (100%)
Reference Conditions	140°F + 460	30 psi + 14.7	459	650
	170° F + 460	50 psi + 14.7	539	763
	170°F + 460	20 psi + 14.7	395	559
	110°F + 460	50 psi + 14.7	567	802
	110°F + 460	20 psi + 14.7	415	587

22050

Continued on next page

Figure 4-2 Example of Eight Segment Characterizer



N	Xn	Yn
0	0.00	0.00
1	5.00	25.00
2	10.00	37.00
3	20.00	55.00
4	31.00	70.00
5	45.00	81.00
6	60.00	87.00
7	80.00	94.50
8	99.99	99.99

4.7 Advanced Math Parameters Set Up Group

Introduction

This data deals with various Logic Gates that are available for use in the controller. It also lists what each of the two inputs and the output can represent. Up to five different gates can be configured.

Algorithm group prompts

Table 4-6 lists all the function prompts in the "Advanced Math" setup group and their definitions.

Table 4-6 Advanced Math Group Definitions

<table>
<tr><th>Lower Display Prompt</th><th>Upper Display Range of Setting or Selection</th><th>Parameter Definition</th></tr>
<tr><td>LOG GATES</td><td>DISABLE
ENABLE</td><td>LOGIC GATE FUNCTION -
DISABLE - disable the logic gate function.
ENABLE - allows the Logic Gate function and the prompts for this option to be shown.
For each gate used, make a selection for:
Gate Type GATEnTYPE
Input A Source GATEn INA
Input B Source GATEn INB
Output Use GATEn OUT
(n) = 1,2,3,4,or 5</td></tr>
<tr><td>GATE(n) TYPE

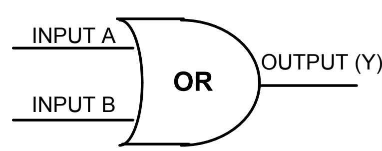
(n = 1, 2, 3, 4, or 5)</td><td>

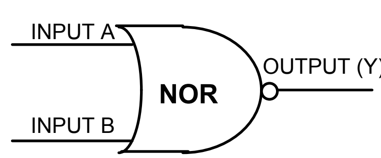
NOT USED

OR

NOR</td><td>GATE TYPE - In digital logic, there are only two states that can be present:
"0" - OFF, or "1" - ON
Listed are definitions of the gates available and their truth table which indicate what happens to the Output with regard to the state of the Inputs.

NOT USED - No Selection

OR - With this gate, if Input A OR Input B are ON, then the Output will be ON. Also, if both Inputs are ON, the Output will also be ON because it takes any one Input being <u>ON</u> to make the Output


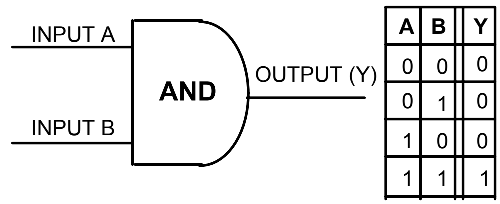
<table><tr><th>A</th><th>B</th><th>Y</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>
NOR - The NOR gate is similar to the OR gate, except that the Output is inverted. It is exactly opposite of the OR gate and is referred to as NOT OR or NOR.
If Input A or Input B are <u>ON</u>, the Output is <u>OFF</u>.


<table><tr><th>A</th><th>B</th><th>Y</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td></tr>
</table>

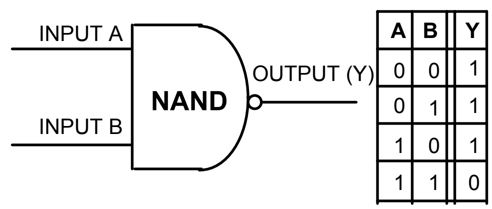
Table 4-6 continued on next page

Table 4-6 Advanced Math Group Definitions, continued

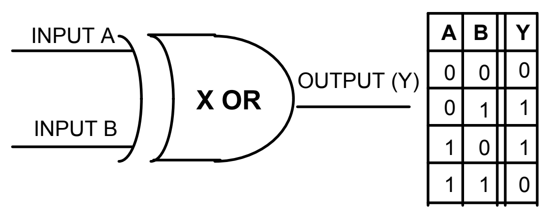
<table>
<tr><th>Lower Display Prompt</th><th>Upper Display Range of Setting or Selection</th><th>Parameter Definition</th></tr>
<tr><td>GATEnTYPE (continued)</td><td>AND</td><td>AND - With this gate, if Input A AND Input B are ON, then the Output will be ON; so that any single Input change will not cause the Output to change unless the other Input is already ON.



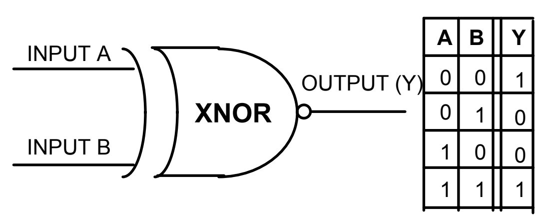
</td></tr>
<tr><td></td><td>NAND</td><td>NAND - NOT AND is the best way to describe the NAND gate. It is an inverted AND gate. When Input A and Input B are ON, the Output is OFF.



</td></tr>
<tr><td></td><td>X OR</td><td>X OR (EXCLUSIVE OR) - The operation of this gate is as its name applies. Exclusively "OR". If Input A OR Input B are ON, the Output will be ON. If Input A and Input B are ON or OFF, the Output will be OFF.



</td></tr>
<tr><td></td><td>XNOR</td><td>X NOR EXCLUSIVE NOR) - The EXCLUSIVE NOR is an inverted EXCLUSIVE OR. If Input A and Input B are ON or OFF, the Output will be ON.



</td></tr>
</table>

Table 4-6 continued on next page

Table 4-6 Advanced Math Group Definitions, continued

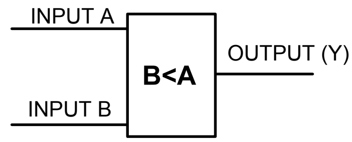
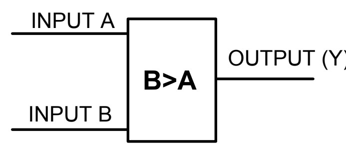
Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
GATEnTYPE (continued)	B LT A (B<A)	**B LT A (B<A) -** B less than A is an Analog Comparator with two Analog Inputs and one Digital (On/Off) Output. A fixed Hysteresis Band of 0.1% of Input B span is applied to these comparators.  **Y = 1 if B<A** **Y = 0 if (B + .001 * Span of B) >A** Example: (B<A) B = 900 (Range 0 – 1000) 900 – (1000 * .001) = 899 If A >900, then Output is ON(1) If A <899, then Output is OFF (0)
	B GT A (B>A)	**B GT A (B>A) -** B greater than A is an Analog Comparator with two Analog Inputs and one Digital (On/Off) Output. A fixed Hysteresis Band of 0.1% of Input B span is applied to these comparators.  **Y = 1 if B>A** **Y = 0 if (B + .001 * Span of B) <A** Example: (B>A) B = 900 (Range 0 – 1000) 900 +(1000 * .001) = 901 If A <900, then Output is ON(1) If A >901, then Output is OFF (0)

Table 4-6 continued on next page

Table 4-6 Advanced Math Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
GATE(n) IN A **(n = 1, 2, 3, 4, or 5)**		**GATE (n) INPUT A -** The selection here will indicate what Input A will be for any of the 5 Gates you want to configure. The following selections apply if the Gate Type is **OR, NOR, AND, NAND, X OR, or X NOR.**
	DIG IN 1 DIG IN 2 DIG OUT 1 DIG OUT 2 DIG OUT 3 DIG OUT 4 GATE 1 OUT GATE 2 OUT GATE 3 OUT GATE 4 OUT GATE 5 OUT FIXED ON FIXED OFF M/A MODE L/R SP L1 DIS / EN AT M/A MODE 2* L/R SP L2* DIS / EN AT2*	**Digital Input 1** **Digital Input 2** **Digital Output 1** **Digital Output 2** **Digital Output 3** **Digital Output 4** **Output from Gate 1** **Output from Gate 2** **Output from Gate 3** **Output from Gate 4** **Output from Gate 5** **Always a "1"** **Always a "0"** **Manual or Auto mode - Loop 1** **0 = Manual 1 = Automatic** **Local or Remote Setpoint - Loop 1** **0 = Local 1 = Remote** **Disable or Enable Adaptive Tune - Loop 1** **0 = Disable 1 = Enable** **Manual or Auto Mode - Loop 2** **0 = Manual 1 = Automatic** **Local or Remote Setpoint - Loop 2** **0 = Local 1 = Remote** **Disable or Enable Adaptive Tune - Loop 2** **0 = Disable 1 = Enable**
		The following selections apply if the Gate Type is **B LT A or B GT A**
	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 LOOP 1 PV LOOP 1 SP CONST K LOOP 2 PV* LOOP 2 SP* * These prompts appear only when 2 Loops are configured.	**Analog Input 1** **Analog Input 2** **Analog Input 3** **Analog Input 4** **Analog Input 5** **Loop 1 Process Variable** **Loop 1 Setpoint** **K Constant** **Loop 2 Process Variable** **Loop 2 Setpoint**
GATE (N) K **(n) = 1, 2, 3, 4, or 5**	–999.0 to +9999	**GATE (N) K CONSTANT -** This selection only appears if "CONST K" is selected a Input A for Gate n.

Table 4-6 continued on next page

Table 4-6 Advance Math Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
GATE(n) IN B (n = 1, 2, 3, 4, or 5)		**GATE (n) INPUT B-** The selection here will indicate what Input B will be for any of the 5 Gates you want to configure. The following selections apply if the Gate Type is **OR, NOR, AND, NAND, X OR, or X NOR.**
	DIG IN 1 DIG IN 2 DIG OUT 1 DIG OUT 2 DIG OUT 3 DIG OUT 4 GATE 1 OUT GATE 2 OUT GATE 3 OUT GATE 4 OUT GATE 5 OUT FIXED ON FIXED OFF M/A MODE L/R SP L1 DIS / EN AT M/A MODE 2* L/R SP L2* DIS / EN AT2*	**Digital Input 1** **Digital Input 2** **Digital Output 1** **Digital Output 2** **Digital Output 3** **Digital Output 4** **Output from Gate 1** **Output from Gate 2** **Output from Gate 3** **Output from Gate 4** **Output from Gate 5** **Always a "1"** **Always a "0"** **Manual or Auto mode - Loop 1** **0 = Manual 1 = Automatic** **Local or Remote Setpoint - Loop 1** **0 = Local 1 = Remote** **Disable or Enable Adaptive Tune - Loop 1** **0 = Disable 1 = Enable** **Manual or Auto Mode - Loop 2** **0 = Manual 1 = Automatic** **Local or Remote Setpoint - Loop 2** **0 = Local 1 = Remote** **Disable or Enable Adaptive Tune - Loop 2** **0 = Disable 1 = Enable**
		The following selections apply if the Gate Type is **B LT A or B GT A**
	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 LOOP 1 PV LOOP 1 SP TOTALIZER LOOP 2 PV* LOOP 2 SP* * These prompts appear only when 2 Loops are configured.	**Analog Input 1** **Analog Input 2** **Analog Input 3** **Analog Input 4** **Analog Input 5** **Loop 1 Process Variable** **Loop 1 Setpoint** **Totalizer Value (see Note 1)** **Loop 2 Process Variable** **Loop 2 Setpoint** Note 1: The Input B Totalizer Value will be the displayed value, not the actual totalizer value.

Table 4-6 continued on next page

Table 4-6 Advanced Math Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
GATE(n) OUT (n = 1, 2, 3, 4, or 5)		**GATE (n) OUTPUT-** The selection here indicates what the output will be for any of the 5 gates that you configure.
	DIG OUT 1	**Digital Output 1**
	DIG OUT 2	**Digital Output 2**
	DIG OUT 3	**Digital Output 3**
	DIG OUT 4	**Digital Output 4**
	ANY GATE	**Output to any Gate**
	M/A MODE	**Manual or Auto mode - Loop 1** **0 = Manual 1 = Automatic**
	L/R SP L1	**Local or Remote Setpoint - Loop 1** **0 = Local 1 = Remote**
	DIS / EN AT	**Disable or Enable Adaptive Tune - Loop 1** **0 = Disable 1 = Enable**
	RESET TOT	**Disable or Enable Totalizer Reset** **0 = Disable 1 = Enable**
	M/A MODE 2*	**Manual or Auto Mode - Loop 2** **0 = Manual 1 = Automatic**
	L/R SP L2*	**Local or Remote Setpoint - Loop 2** **0 = Local 1 = Remote**
	DIS / EN AT2*	**Disable or Enable Adaptive Tune - Loop 2** **0 = Disable 1 = Enable**
	* These prompts appear only when 2 Loops are configured.	

4.8 Output Algorithm Parameters Set Up Group

Introduction

This data deals with various output types in the controller, the Digital Output Status, and the Current Duplex functionality.

Algorithm group prompts

Table 4-7 lists all the function prompts in the "Output Algorithm" setup group and their definitions.

Table 4-7 Output Algorithm Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
OUT ALG		The **OUTPUT ALGORITHM** lets you select the type of output you want. *Selections are model dependent. For example, current output models cannot be configured for Time Proportioning Simplex Output.*
	TIME	**TIME SIMPLEX** — This Output algorithm uses Digital Output 3 for Time Proportional Control. The output is updated per the Loop sampling rate selection. Time Proportional Output has a resolution of 4.44 msec. Cycle Time is adjustable from 1 to 120 seconds.
	CURRENT	**CURRENT SIMPLEX** — Type of output using one 4 to 20 mA signal that can be fed into a positive or negative grounded load of 0 to 1000 ohms. The signal can be re-calibrated for any desired range from 4 to 20 mA for 0 to 100% output.
	TIME DPLX	**TIME DUPLEX** — This Output algorithm uses Digital Outputs 3 and 4 for Duplex Time Proportional Control. The outputs are updated per the Loop sampling rate selection. Time Proportional Output has a resolution of 4.44 msec. Cycle Time is adjustable from 1 to 120 seconds.
	CUR DPLX	**CURRENT DUPLEX** is similar to current simplex but uses a second current output. The second output is usually scaled so that zero and span correspond with 0% and 50% output (cool zone). When the output is 0 to 50%, the controller uses tuning parameter set #2, when the output is 50 to 100% it uses set #1. Other prompts affected: "4-20 RNG”
	CUR TIME	**CURRENT/TIME DUPLEX (Digital Output 3 = HEAT)** is a variation of duplex with current active for 0 to 50% output (tuning set 2) and Time is active 50 to 100% output (tuning set 1). Other prompts affected: "4-20 RNG”
	TIME CUR	**TIME CURRENT DUPLEX (Digital Output 3 = COOL)** is similar to "CUR-TIME" except that current is active for 50 to 100% and Time is active for 0 to 50%. Other prompts affected: "4-20 RNG”.

Table 4-7 continued on next page

Table 4-7 Output Algorithm Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
4-20 RNG		**CURRENT DUPLEX RANGE ALGORITHM** — Used with Output Algorithm selections "CUR-DPLX," "CUR-TIME", or "TIME-CUR."
	50 PCT	**CURRENT DUPLEX RANGE (SPLIT)** For "CUR DPLX" this enables the normal control current output to provide iheat control and the 2nd current output to provide cool control. To enable this, "CUR OUT 2" in the “Options” Set up group must be: •Selected for OUTPUT • 2ND current output is scaled as desired for 0-50% controller output (4mA set to 50; 20mA set to 0) • Deadband for this configuration only applies to the Current output The second current output must have the Deadband scaled in. For example: If a 2% Deadband is desired, then enter a “2.0” for the “Deadband” selection in the Control group. This will apply Deadband to the Current Output. In the “Opyions” group, set the 2nd Current Output “4mA VAL” selection to “49.0” and the “20mA” selection to “0”.
	100PCT	**CURRENT DUPLEX RANGE (FULL)** enables the normal control current output to provide duplex control over 0 - 100% of the controller output by providing cool control over 4–12 mA and Heat control over 12–20 mA. The second current output is not required for this type of duplex operation.
OUTALG 2		The **OUTPUT ALGORITHM** lets you select the type of output you want for the **second** control loop See "OUTALG" for definitions.
	NONE	**NONE -** No selection
	TIME	**TIME -** Uses Digital Output 4
	CURRENT	**CURRENT -** Uses second current output
	CUR DPLX	**CUR DPLX-** Uses second current output
	CUR TIME	**CUR TIME -** Digital Output 4 = Heat, Second Current Output = Cool
	TIME CUR	**TIME CUR -** Digital Output 4 = Cool, Second Current Output = Heat
DO STATE		**DIGITAL OUTPUT STATUS AT 0% OUTPUT -** allows the following selections:
	3OFF 4OFF	3OFF 4OFF Output 3 de-energized Output 4 de-energized
	3ON 4ON	3ON 4ON Output 3 energized Output 4 energized
	3OFF 4ON	3OFF 4ON Output 3 de-energized Output 4 energized
	3ON 4 OFF	3ON 4 OFF Output 3 energized Output 4 de-energized **ATTENTION** For units not configured for Time Duplex, Output 4 is always de-energized.

4.9 Input 1 Through 4 Parameters Set Up Group

Introduction

These are the parameters required for Inputs 1 through 4; transmitter characterization, high and low range values in engineering units, Ratio, Bias, and Filter. Also, Deadtime (Input 3 only) and Xmitter 4 (Input 4 only).

Input 1 through 4 group prompts

Table 4-8 lists all the function prompts in the Input 1 through 4 setup group and their definitions.

Table 4-8 Input 1 through 4 Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
XMITTERn (n = 1, 2, 3, or 4) **ATTENTION** Change of input characterization selection results in loss of any field calibration and restores factory calibration of linear range 1 to 5 Volts.	DISABLE B TC E TC J TC K TC NNM NIC TC R TC S TC T TC W TC 100 PT 100 PT LO 200PT 500PT LINEAR SQ ROOT IN2 NO R/B (Xmitter 4 only)	**TRANSMITTER CHARACTERIZATION** — This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. **DISABLE** - Disable Input **B TC -** B Thermocouple **E TC-** E Thermocouple **J TC-** J Thermocouple **K TC-** K Thermocouple **NNM-** NiNiMo Thermocouple **NIC TC-** Nicrosil Nisil Thermocouple **R TC-** R Thermocouple **S TC-** S Thermocouple **T TC-** T Thermocouple **W TC-** W Thermocouple **100 PT -** 100 Ohm RTD High **100 LOW -** 100 Ohm RTD Low **200PT-** 200 Ohm RTD **500PT-** 500 Ohm RTD **LINEAR -** Linear* **SQ ROOT -** Square Root* **IN2 NO R/B** - allows analog input 2 signal (without Input 2 Ratio or Bias) to be configured with Input 4 Ratio and Bias without need to use a physical analog input for input 4. * *No Characterization*
INn HI (n = 1, 2, 3, or 4)	–999 to 9999 in Engineering units	**INPUT n HIGH RANGE VALUE** in engineering units. Available only if Linear or Square Root transmitter characterization is selected. Scale the #1 input signal to the display value you want for 100%. EXAMPLE: Actuation (Input) = 4 to 20 mA Process Variable = Flow Range of Flow = 0 to 250 Gal/Min High Range display value = 250 Low Range display value = 0 Then 20 mA = 250 Gal/Min The control setpoint will be limited by the range of units selected here.

Table 4-8 continued on next page

Table 4-8 Input 1 through 4 Group definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
INn LO (n = 1, 2, 3, or 4)	–999 to 9999 in Engineering units	**INPUT n LOW RANGE VALUE** in engineering units. Available only if Linear or Square Root transmitter characterization is selected. Scale the #1 input signal to the display value you want for 0%. See example on previous page. The control setpoint for Input 1 will be limited by the range of units selected here.
RATIO n (n = 1, 2, 3, or 4)	–20.00 to 20.00	**RATIO ON INPUT n** - select the Ratio value you want on the input designated
BIAS INn (n = 1, 2, 3, or 4)	–999 to 9999	**BIAS ON INPUT n** - Bias is used to compensate the input for drift of an input value due to deterioration of a sensor, or some other cause. Select the bias value you want on the input designated.
FILTER n (n = 1, 2, 3, or 4)	0 to 120 seconds No filter = 0	**FILTER FOR INPUT n** - A software digital filter is provided for the Input designated to smooth the input signal. You can configure the first order lag time constant from 1 to 120 seconds. If you do not want filtering, enter 0.
DEADTIME3 (INPUT 3 ONLY)	0.0 TO 60.0 Minutes	**DEADTIME FOR INPUT 3** - The third input can be configured to introduce a selectable Deadtime into the control algorithm. Deadtime is the delay in response to any change to Analog Input 3. Specifically, Deadtime is the interval of time between the initiation of a change to Analog Input 3 and the start of the resulting response and displayed value of Input 3. Loops using this feature should always use a loop sample rate of 3X per second. The controller calculates a ramp between sample points and uses that ramp to calculate the input for intermediate points between samples. The controller will save a total of 540 sample points for the Deadtime calculations. For example: Assume a Deadtime of 34.0 minutes. This has a sample rate of 4.000 seconds. Now, assume that sample #1 was 50.0, and sample #2, four seconds after sample #1, was 74.0. The controller calculates a ramp of +24.0 over 4.000 seconds. This means that the controller will perform as if the input changes at $\frac{+24.0}{4.000 \times 3}$ or +2.000 per 0.333 seconds. Deadtime can be configured to any value between 0.0 and 60.00 minutes.

4.10 Input 5 Parameters Set Up Group

Introduction

These are the parameters required for optional input 5 which can be a Direct Thermocouple, RTD, or Pulse Input; Type, Input 5 Pulse, Transmitter Characterization, High and Low range values in engineering units, Ratio, Bias, Filter, Burnout, and Emissivity.

Input 5 group prompts

Table 4-9 lists all the function prompts in the Optional Input 5 setup group and their definitions.

Table 4-9 Input 5 Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
IN 5 TYPE **ATTENTION** Change of input type selection results in loss of any field calibration and restores factory calibration.	 DISABLE B TC E TC J TC K TC NNM NIC TC R TC S TC T TC W TC 100 PT 100 LO PT 200PT 500PT RH RADIAM MILLIAMPS 0–10 MV 10–50 MV 1–5V 0–10V PULSE	**INPUT 5 ACTUATION TYPE -** This selection determines what actuation you are going to use for Input 5. **DISABLE** - Disable Input 5 **B TC -** B Thermocouple **E TC-** E Thermocouple **J TC-** J Thermocouple **K TC-** K Thermocouple **NNM-** NiNiMo Thermocouple **NIC TC-** Nicrosil Nisil Thermocouple **R TC-** R Thermocouple **S TC-** S Thermocouple **T TC-** T Thermocouple **W TC-** W Thermocouple **100 PT -** 100 Ohm RTD High **100 LOW -** 100 Ohm RTD Low **200PT-** 200 Ohm RTD **500PT-** 500 Ohm RTD **RH RADIAM -** Radiamatic (type RH only) **4 to 20 MILLIAMPS*** **0 TO 10 MILLIVOLTS*** **10 TO 50 MILLIVOLTS*** **1 TO 5 VOLTS*** **0 TO 10 VOLTS*** **PULSE -** 0 to 25 Khz (automatically selected when a pulse Input board is installed).Minimum Span 100Hz ***** *Linear Range*
IN5 PULSE	 DISABLE FREQ INP PULSE	**INPUT 5 PULSE ACTUATION** - available only when a Pulse Input board is installed. **DISABLE** - disables Input 5 **FREQUENCY INPUT** - for Flow Transmitters **PULSE** - for Setpoint/Remote Setpoint adjustments. Refer to "Operation" section for operational overview.

Table 4-9 continued on next page

Table 4-9 Input 5 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
XMITTER 5	B TC E TC J TC K TC NNM NIC TC R TC S TC T TC W TC 100 PT 100 LO PT 200PT 500PT LINEAR SQ ROOT	**TRANSMITTER CHARACTERIZATION** - This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. **B TC -** B Thermocouple **E TC-** E Thermocouple **J TC-** J Thermocouple **K TC-** K Thermocouple **NNM-** NiNiMo Thermocouple **NIC TC-** Nicrosil Nisil Thermocouple **R TC-** R Thermocouple **S TC-** S Thermocouple **T TC-** T Thermocouple **W TC-** W Thermocouple **100 PT -** 100 Ohm RTD High **100 LOW -** 100 Ohm RTD Low **200PT-** 200 Ohm RTD **500PT-** 500 Ohm RTD **LINEAR -** Linear* **SQ ROOT -** Square Root* *no characterization
IN5 HI	–999 to 9999 in Engineering units	**INPUT 5 HIGH RANGE VALUE** in engineering units is displayed for Input 5 but can only be configured for linear, square root, or pulse actuations only.
IN5 LO	–999 to 9999 in Engineering units	**INPUT 5 LOW RANGE VALUE in** engineering units is displayed for Input 5 but can only be configured for linear, square root, or pulse actuations only.
RATIO IN5	–20.00 to +20.00	**INPUT 5 RATIO VALUE** - Select the ratio value for Input 5.
BIAS IN5	–999 to 9999 in Engineering units	**INPUT 5 BIAS VALUE** - Select the bias value for Input 5.
FILTER IN5	0 to 120 seconds No filter = 0	**FILTER FOR INPUT FIVE**— A software digital filter is provided for input 5 to smooth the input signal. You can configure the first order lag constant from 1 to 120 seconds. If you do not want filtering, enter 0.

Table 4-9 continued on next page

Table 4-9 Input 5 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
BURNOUT5		**BURNOUT PROTECTION (SENSOR BREAK)** - provides all input types with upscale or downscale protection if the input fails.
	NONE	**NO BURNOUT** - Failsafe output applied for failed input but not out-of-range.
	UP	**UPSCALE BURNOUT** - will make the indicated PV signal increase when a sensor fails, and flash in the upper display. Do not use for Linear Input.
	DOWN	**DOWNSCALE BURNOUT** - will make the indicated PV signal decrease when a sensor fails, and flash the upper display. Do not use for Linear Input.
EMISSIV 5	0.01 to 1.00	**EMISSIVITY FOR (RH) RADIAMATIC INPUTS -** A radiamatic pyrometer converts radiant energy emitted by a target into electrical energy. Emissivity is a correction factor applied to the radiamatic input signal that is the ratio of the actual energy emitted from the target to the energy which would be emitted if the target were a perfect radiator. Only available on Input 5 "RH" Radiamatic.

4.11 Control Parameters Set Up Group

Introduction

The functions listed in this group deal with how the Single Loop Process Controller or Loop 1 of a Two Loop Process controller will control the process including: PV Source, Number of tuning parameter sets, Setpoint source, Tracking, Power-up recall, Setpoint limits, Output direction, rate and limits, Dropoff, Deadband and Hysteresis.

Control group prompts

Table 4-10 lists all the function prompts in the Control setup group and their definitions.

Table 4-10 Control Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PV SOURCE		**PROCESS VARIABLE SOURCE -** select the source of the Process Variable.
	INPUT 1	**INPUT 1**
	INPUT 2	**INPUT 2**
	INPUT 3	**INPUT 3**
	INPUT 4	**INPUT 4**
	INPUT 5	**INPUT 5**
	IN ALG 1	**INPUT ALGORITHM 1**
	IN ALG 2	**INPUT ALGORITHM 2**
PID SETS		**NUMBER OF TUNING PARAMETER SETS** — This selection lets you choose one or two sets of tuning constants (gain, rate, and reset).
	1 ONLY	**ONE SET ONLY** — Only one set of tuning parameters is available. Configure the values for: Gain (proportional band), Rate, Reset Time, and Cycle Time (if time proportional is used).
	2KEYBD	**TWO SETS KEYBOARD SELECTABLE** — Two sets of tuning parameters can be configured and can be selected at the operator interface or by using the Digital Inputs. Press LOWR DISP key until you see "PID SET1" or "PID SET2" to switch between sets. Configure the values for: Gain, Rate , Reset, Cycle Time Gain #2, Rate #2, Reset#2, Cycle#2 Time *See Subsection 5.10 for procedures.*
	2PV SW	**TWO SETS PV AUTOMATIC SWITCHOVER** — When the process variable is *GREATER* than the value set at prompt "SW VALUE" (Switchover Value), the controller will use Gain, Rate, Reset, and Cycle Time. The active PID SET can be read in the lower display. When the process variable is *LESS* than the value set at prompt "SW VALUE," the controller will use Gain #2, Rate #2, Reset #2, and Cycle #2 Time. The active PID SET can be read in the lower display. Other prompts affected: SW VALUE

Table 4-10 continued on next page

Table 4-10 Control Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PID SETS (CONTINUED	2SP SW	**TWO SETS SP AUTOMATIC SWITCHOVER** — When the setpoint is *GREATER* than the value set at prompt "SW VALUE" (Switchover Value), the controller will use Gain, Rate, Reset, and Cycle. When the setpoint is *LESS* than the value set at prompt "SW VALUE," the controller will use Gain #2, Rate #2, Reset #2, and Cycle #2. Other prompts affected: SW VALUE
	GAIN SCDL	**GAIN SCHEDULING -** allows you to schedule 8 user defined Gain segments applied over a user defined PV range. Enter Gain and PV values under Set Up prompt "TUNING". **ATTENTION** Gain scheduling automatically disables Adaptive Tune for this loop. PB or GAIN selections in this group also applies.
SW VALUE	Value in engineering units	**AUTOMATIC SWITCHOVER VALUE**—This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #2 to Set #1. Only appears when PID SETS selections “2PV SW” or “2SP SW” are selected.
LSP's		**LOCAL SETPOINT SOURCE** — This selection determines what your local setpoint source will be; One local or Two local. Toggled by the SP1/SP2 key.
	1ONLY	**LOCAL SETPOINT** — The setpoint entered from the keyboard.
	TWO	**TWO LOCAL SETPOINTS** — This selection lets you switch between two local setpoints using the [SP1/SP2] key.
	THREE	**THREE LOCAL SETPOINTS** — Setpoint 3 toggled by RSP/CAS key. LSP 3 is mutually exclusive with RSP or Internal Cascade.
RSP SOURC		**REMOTE SETPOINT SOURCE** — This selection determines what your remote setpoint source will be when toggled by the RSP/CAS key or Digital Input. Not available for Cascade PID Loop.
	NONE INPUT 2 INPUT 3 INPUT 4 INPUT 5 IN ALG 1 IN ALG 2	**NONE** - No remote setpoint **INPUT 2** - Remote Setpoint is Input 2 **INPUT 3** - Remote Setpoint is Input 3 **INPUT 4** - Remote Setpoint is Input 4 **INPUT 5** - Remote Setpoint is Input 5 **IN ALG 1** - Remote Setpoint using Input 1 algorithm **IN ALG 2** - Remote Setpoint using Input 2 algorithm

Table 4-10 continued on next page

Table 4-10 Control Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
AUTO BIAS		**AUTO BIAS** — is used for bumpless transfer when transferring from local setpoint to remote setpoint. Auto Bias calculates and adds a bias to remote setpoint input each time a transfer is made. Only available for Input 2 thru 5 RSP Source only and if no tracking is selected.
	ENABLE DISABLE	**ENABLE** - enables auto bias. **DISABLE** - disables auto bias.
SP TRACK		**SETPOINT TRACKING** — The local setpoint can be configured to track either PV or RSP as listed below. Not configurable when Auto Bias is set.
	NONE	**NO TRACKING** — If local setpoint tracking is not configured, the LSP will not be altered when transfer from RSP to LSP is made.
	PV	**PV -** Local setpoint track the PV when in manual.
	RSP	**RSP -** Local setpoint track remote setpoint. When the controller transfers out of remote setpoint, the last value of the remote setpoint (RSP) is inserted into the local setpoint.
PWR MODE		**POWER UP CONTROLLER MODE RECALL** — This selection determines which mode and setpoint the controller will use when the controller restarts after a power loss. Select one from below:
	MANUAL	**MANUAL, LSP** — At power-up, the controller will use *manual* mode with the local setpoint displayed.
	A or M SP	**LAST MODE/LAST SETPOINT** used before power down.
	A or M LSP	**LAST MODE/LAST LOCAL SETPOINT** on power down.
SP HILIM	0 to 100% of PV span in engineering units with decimal place	**SETPOINT HIGH LIMIT*** — This selection prevents the local and remote setpoints from going above the value selected here. The setting must be equal or less than the upper range of the inputs.
SP LOLIM	0 to 100% of PV span in engineering units with decimal place	**SET POINT LOW LIMIT*** — This selection prevents the local and remote setpoints from going below the value selected here. The setting must be equal or greater than the lower range of the inputs.
*The Local Setpoint will automatically adjust itself to be within the setpoint limit range. For example, if SP = 1500 and the SP HILIM is changed to 1200, the new Local Setpoint will be 1200.		

Table 4-10 continued on next page

Table 4-10 Control Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
ACTION		**CONTROL OUTPUT DIRECTION** — select Direct or Reverse.
	DIRECT	**DIRECT ACTING CONTROL** — The controller's output increases as the process variable increases.
	REVERSE	**REVERSE ACTING CONTROL** — The controller's output decreases as the process variable increases.
OUT RATE	DISABLE ENABLE	**OUTPUT CHANGE RATE -** Enables or Disables the Output Change Rate. The maximum rate is set at Prompt "PCT/MIN UP" or "PCT/MIN DN" . Only available for PID-A, PID-B, PD+MR control algorithms. ENABLE - allows output rate DISABLE - disables output rate
PCT/MIN UP	0 to 9999%/minute	**OUTPUT RATE UP VALUE -** This selection limits the rate at which the output can change upward. Enter a value in percent/minute. Appears only if "OUT RATE" is enabled. "0" means no output rate applied.
PCT/MIN DN	0 to 9999%/minute	**OUTPUT RATE DOWN VALUE -** This selection limits the rate at which the output can change downward. Enter a value in percent/minute. Appears only if "OUT RATE" is enabled. "0" means no output rate.
OUT HI LIM	–5.0 to 105.0% of output	**HIGH OUTPUT LIMIT** — This is the highest value of output beyond which you do not want the controller automatic output to exceed. Use 0 to 100% for digital output type. Use 5 to 105% for current output
OUT LO LIM	–5.0 to 105.0% of output	**LOW OUTPUT LIMIT** — This is the lowest value of output below which you do not want the controller automatic output to exceed. Use 0 to 100% for digital output type. Use 5 to 105% for current output
I HI LIM	Within the range of the output limits	**HIGH RESET LIMIT** - This is the highest value of output beyond which you want no reset to occur.
I LOLIM	Within the range of the output limits	**LOW RESET LIMIT** - This is the lowest value of output beyond which you want no reset to occur.
DROPOFF	–5 to 105.0% of output	**CONTROLLER DROPOFF VALUE** — Output value that below which the controller output will dropoff to the low output limit value set in prompt "OUT LOLIM."
DEADBAND	–5.0 to 25.0% 0 to 25.0%	**DEADBAND** is an adjustable gap between the operating ranges of output 1 and output 2 in which neither output operates (positive value) or both outputs operate (negative value). Time Duplex On-Off Duplex

Table 4-10 continued on next page

Table 4-10 Control Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
OUT HYST	0.0 to 5.0% of PV Span	**HYSTERESIS (OUTPUT RELAY)** is an adjustable overlap of the ON/OFF states of each control output. This is the difference between the value of the process variable at which the control outputs energize and the value at which they de-energize. Only applicable for ON/OFF control.
FAIL MODE		**FAILSAFE MODE**
	NON LATCH	**NON LATCH** - when the controller has gone to failsafe and the problem is corrected, the controller will go to automatic mode on power up at the setpoint that was being used.
	LATCHING	**LATCHING** - When the controller has gone to failsafe and the problem is corrected, the controller will stay in manual mode.
FAILSAFE	0 to 100%	**FAILSAFE OUTPUT VALUE** — The value used here will also be the output level when you have Communications SHED or when NO BURNOUT is configured and Input 1 fails.
PBorGAIN*		**PROPORTIONAL BAND UNITS** — Select one of the following for the Proportional (P) term of the PID algorithm:
	PB PCT	**PROPORTIONAL BAND** — Selects units of percent proportional band for the P term of the PID algorithm. Where: $PB\% = \frac{100\%FS}{GAIN}$
	GAIN	**GAIN** selects the unitless term of gain for the P term of the PID algorithm. Where: $GAIN = \frac{100\%FS}{PB\%}$
MINorRPM*		**RESET UNITS** — Selects units of minutes or repeat per minutes for the I term of the PID algorithm. 20 Repeats per Minute = 0.05 Minutes per Repeat.
	RPM	**REPEATS PER MINUTE** — The number of times per minute that the proportional action is repeated by reset.
	MINUTES	**MINUTES PER REPEAT** — The time between each repeat of the proportional action by reset.

*Selection here is used for both Loop 1 and Loop 2 if available. Also applies to Gain Scheduling on Loops 1 and 2.

4.12 Control2 Parameters Set Up Group

Introduction

The functions listed in this group deal with how **Loop 2** of a Two Loop Process controller will control the process including: PV Source, Number of tuning parameter sets, Setpoint source, Tracking, Power-up recall, Setpoint limits, Output direction, rate and limits, Dropoff, Deadband and Hysteresis.

Control2 group prompts

Table 4-11 lists all the function prompts in the Control2 setup group and their definitions.

Table 4-11 Control2 Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PV2 SRC		**PROCESS VARIABLE 2 SOURCE -** select the source of the Process Variable for Loop 2.
	INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5 IN ALG 1 IN ALG 2	**INPUT 1** **INPUT 2** **INPUT 3** **INPUT 4** **INPUT 5** **INPUT ALGORITHM 1** **INPUT ALGORITHM 2**
PID SETS		**NUMBER OF TUNING PARAMETER SETS** — This selection lets you choose one or two sets of tuning constants (gain, rate, and reset).
	1 ONLY	**ONE SET ONLY** — Only one set of tuning parameters is available. Configure the values for: Gain (proportional band) Rate Reset Time Cycle Time (if time proportional is used)
	2KEYBD	**TWO SETS KEYBOARD SELECTABLE** — Two sets of tuning parameters can be configured and can be selected at the operator interface or by using the Digital Inputs. Press LOWR DISP key until you see "PID SET3" or "PID SET4" to switch between sets. Configure the values for: Gain#3, Rate#3 , Reset#3, Cycle3Time Gain #4, Rate #4, Reset#4, Cycle#4 Time *See Subsection 5.10 for procedure.*
	2PV SW	**TWO SETS PV AUTOMATIC SWITCHOVER** — When the process variable is *GREATER* than the value set at prompt "SW VALUE" (Switchover Value), the controller will use Gain3, Rate3, Reset3, and Cycle 3Time. The active PID SET can be read in the lower display. When the process variable is *LESS* than the value set at prompt "SW VALUE," the controller will use Gain #4, Rate #4, Reset #4, and Cycle #4 Time. The active PID SET can be read in the lower display. Other prompts affected: SW VALUE

Table 4-11 continued on next page

Table 4-11 Control2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PID SETS (CONTINUED	2SP SW	**TWO SETS SP AUTOMATIC SWITCHOVER** — When the setpoint is *GREATER* than the value set at prompt "SW VALUE" (Switchover Value), the controller will use Gain3, Rate3, Reset3, and Cycle3. When the setpoint is *LESS* than the value set at prompt "SW VALUE," the controller will use Gain #4, Rate #4, Reset #4, and Cycle #4. Other prompts affected: SW VALUE
	GAIN SCDL	**GAIN SCHEDULING -** allows you to schedule 8 user defined Gain segments applied over a user defined PV range. Enter Gain and PV values under Set Up prompt "TUNING2". **ATTENTION** Gain scheduling automatically disables Adaptive Tune for this loop. PB or GAIN selections in "CONTROL" group also applies.
SW VALUE	Value in engineering units	**AUTOMATIC SWITCHOVER VALUE** —This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #4 to Set #3. Only appears when PID SETS selections “2PV SW” or “2SP SW” are selected.
LSP's		**LOCAL SETPOINT SOURCE** — This selection determines what your local setpoint source will be; One local or Two local. Toggled by the SP1/SP2 key.
	1ONLY	**LOCAL SETPOINT** — The setpoint entered from the keyboard.
	TWO	**TWO LOCAL SETPOINTS** — This selection lets you switch between two local setpoints using the SP1/SP2 key.
	THREE	**THREE LOCAL SETPOINTS** — Setpoint 3 toggled by RSP/CAS key. LSP 3 is mutually exclusive with RSP or Internal Cascade.
RSP SOURC		**REMOTE SETPOINT SOURCE** — this selection determines what your remote setpoint source will be when toggled by the RSP/CAS key or Digital Input.
	NONE INPUT 2 INPUT 3 INPUT 4 INPUT 5 IN ALG 1 IN ALG 2	**NONE** - No remote setpoint **INPUT 2** - Remote Setpoint is Input 2 **INPUT 3** - Remote Setpoint is Input 3 **INPUT 4** - Remote Setpoint is Input 4 **INPUT 5** - Remote Setpoint is Input 5 **IN ALG 1** - Remote Setpoint using Input 1 algorithm **IN ALG 2** - Remote Setpoint using Input 2 algorithm

Table 4-11 continued on next page

Table 4-11 Control2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
AUTO BIAS		**AUTO BIAS** — is used for bumpless transfer when transferring from local setpoint to remote setpoint. Auto Bias calculates and adds a bias to remote setpoint input each time a transfer is made. Available for any analog Input RSP Source and if no tracking is selected.
	ENABLE DISABLE	**ENABLE** - enables auto bias. **DISABLE** - disables auto bias.
SP TRACK		**SETPOINT TRACKING** — The local setpoint can be configured to track either PV or RSP as listed below: Not configurable when Auto Bias is set.
	NONE	**NO TRACKING** — If local setpoint tracking is not configured, the LSP will not be altered when transfer from RSP to LSP is made.
	PV	**PV -** Local setpoint tracks the PV when in manual.
	RSP	**RSP -** Local setpoint tracks remote setpoint. When the controller transfers out of remote setpoint, the last value of the remote setpoint (RSP) is inserted into the local setpoint.
SP HILIM	0 to 100% of span input in engineering units with decimal place	**SETPOINT HIGH LIMIT*** — This selection prevents the local and remote setpoints from going above the value selected here. The setting must be equal or less than the upper range of the inputs.
SP LOLIM	0 to 100% of span input in engineering units with decimal place	**SETPOINT LOW LIMIT*** — This selection prevents the local and remote setpoints from going below the value selected here. The setting must be equal or greater than the lower range of the inputs.
*The Local Setpoint will automatically adjust itself to be within the setpoint limit range. For example, if SP = 1500 and the SP HILIM is changed to 1200, the new Local Setpoint will be 1200.		
ACTION		**CONTROL OUTPUT DIRECTION** — select Direct or Reverse.
	DIRECT	**DIRECT ACTING CONTROL** — The controller's output increases as the process variable increases.
	REVERSE	**REVERSE ACTING CONTROL** — The controller's output decreases as the process variable increases.
OUT RATE		**OUTPUT CHANGE RATE -** Enables or Disables the Output Change Rate. The maximum rate is set at prompt “PCT/MIN UP” or “PCT/MIN DN”.
	DISABLE ENABLE	**DISABLE** - disables output rate **ENABLE** - allows output rate

Table 4-11 continued on next page

Table 4-11 Control2 Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PCT/MIN UP	0 to 9999%/minute	**OUTPUT RATE UP VALUE -** This selection limits the rate at which the output can change upward. Enter a value in percent/minute. Appears only if “OUT RATE” is enabled. “0” means no output rate applied.
PCT/MIN DN	0 to 9999%/minute	**OUTPUT RATE DOWN VALUE -** This selection limits the rate at which the output can change downward. Enter a value in percent/minute. Appears only if “OUT RATE” is enabled. “0” means no output rate.
OUT HI LIM	–5.0 to 105.0% of output	**HIGH OUTPUT LIMIT** — This is the highest value of output beyond which you do not want the controller automatic output to exceed. Use 0 to 100% for digital output type. Use 5 to 105% for current output.
OUT LO LIM	–5.0 to 105.0% of output	**LOW OUTPUT LIMIT** — This is the lowest value of output below which you do not want the controller automatic output to exceed. Use 0 to 100% for digital output type. Use 5 to 105% for current output.
I HI LIM	Within the range of the output limits	**HIGH RESET LIMIT** - this is the highest value of output beyond which you want no reset to occur.
I LOLIM	Within the range of the output limits	**LOW RESET LIMIT** - this is the lowest value of output beyond which you want no reset to occur.
DROPOFF	–5 to 105.0% of output	**CONTROLLER DROPOFF VALUE** — Output value that below which the controller output will dropoff to the low output limit value set in prompt "OUT LOLIM."
DEADBAND	 –5.0 to 25.0% 0 to 25.0%	**DEADBAND** is an adjustable gap between the operating ranges of output 1 and output 2 in which neither output operates (positive value) or both outputs operate (negative value). Time Duplex, Cur Duplex, Cur Time, Time Cur On-Off Duplex
FAIL MODE	 NON LATCH LATCHING	**FAILSAFE MODE** **NON LATCH** - When the controller has gone to failsafe and the problem is corrected, the controller will go to automatic mode on power up at the setpoint that was being used. **LATCHING** - When the controller has gone to failsafe and the problem is corrected, the controller will stay in manual mode.
FAILSAFE	0 to 100%	**FAILSAFE OUTPUT VALUE** — The value used here will also be the output level when you have Communications SHED or when NO BURNOUT is configured and input 1 fails.

4.13 Options Set Up Group

Introduction

Configure the Digital Inputs to a specific contact closure response, or configure the 2nd Current Output to be a specific selection with desired scaling.

Table 4-12 lists all the function prompts in the Option setup group and their functions.

Table 4-12 Option Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CUR OUT 2		**2ND CURRENT OUTPUT**—primarily is used for Loop 2 output but it also can represent one of 13 control parameters. The display for 2nd current output viewing will be in engineering units for all but output. Output will be in percent. Other prompts affected by these selections: "4mA VAL" and "20mA VAL."
	DISABL	**NO 2nd CURRENT OUTPUT**
	INPUT 1	**INPUT 1** represents the value of the configured range of input 1.
	INPUT 2	**INPUT 2** represents the value of the configured range of input 2.
	INPUT 3	**INPUT 3** represents the value of the configured range of input 3.
	INPUT 4	**INPUT 4** represents the value of the configured range of input 4.
	INPUT 5	**INPUT 5** — This represents the configured range of input 5. FOR EXAMPLE: Type "J" Thermocouple (0 to 1600°F) 0°F display = 0% output 1600°F display = 100% output
	PV	**PROCESS VARIABLE** — Represents the value of the Process Variable for Loop 1.
	DEVIATION	**DEVIATION (PROCESS VARIABLE MINUS SETPOINT)** — Represents –100 to +100% of the selected PV span in engineering units for Loop 1. When Deviation is selected, only one operating parameter will be entered. This value represents the deviation level that will produce 20mA output. Zero deviation will produce a center scale (12mA) output. A negative deviation equal in magnitude to the 2nd current output high value will produce a low end (4mA) output.
	OUTPUT	**OUTPUT** — Represents the displayed controller output in percent (%) for Loop 1.
	SP	**SETPOINT** — Represents the value of the setpoint in units of PV for Loop 1.

Table 4-12 continued on next page

Table 4-12 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
CUR OUT 2 (continued)	LSP 1	**SETPOINT 1**— Represents the value of local setpoint#1 in units of PV for Loop 1.
	IN ALG 1	**INPUT ALGORITHM 1 OUTPUT** — Represent the output from input algorithm 1.
	IN ALG 2	**INPUT ALGORITHM 2 OUTPUT** — Represent the output from input algorithm 2.
	PV LOOP2	**PROCESS VARIABLE** — Represents the value of the Process Variable for Loop 2.
	DEV LOOP2	**DEVIATION 2 (PROCESS VARIABLE MINUS SETPOINT)** — Represents –100 to +100% of the selected PV span in engineering units for Loop 2. When Deviation is selected, only one operating parameter will be entered. This value represents the deviation level that will produce 20mA output. Zero deviation will produce a center scale (12mA) output. A negative deviation equal in magnitude to the 2nd current output high value will produce a low end (4mA) output.
	OUTPUT2	**OUTPUT 2** — Represents the displayed controller output in percent (%) for Loop 2.
	SP LOOP 2	**SETPOINT 2**— Represents the value of the setpoint in units of PV for Loop 2.
	LSP LOOP2	**LOCAL SETPOINT 2**— Represents the value of Local Setpoint#1 in units of PV for Loop 2.
4mA VAL	Low Scale Value within the range of the selected variable to represent 4 mA	**2ND CURRENT OUTPUT LOW SCALING FACTOR** — Use a value in engineering units to represent all above except output. Use value in percent (%) for Output. (Output can be between –5 and +105%.)
20mA VAL*	High Scale Value within the range of the selected variable to represent 20 mA	**2ND CURRENT OUTPUT HIGH SCALING FACTOR** — Use a value in engineering units to represent all above except output. Use a value in percent (%) for Output. (Output can be between –5 and +105%.) *When Deviation is selected, only one operating parameter will be entered. This value represents the deviation level that will produce 20 mA output. Zero deviation will produce a center scale (12 mA) output. A negative deviation equal in magnitude to the Auxiliary Output High Value will produce a low end (4 mA) output.

Table 4-12 continued on next page

Table 4-12 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DIG IN 1		**DIGITAL INPUT ONE SELECTIONS** — Contact closure enables one of the following (applies to Loop 1 on 2 Loop models). The controller returns to its original state when contact opens, except where noted. If the selection for the Digital Inputs are in conflict with each other, whichever switch is closed first will take precedence. If multiple switches are closed simultaneously, then the lowest numbered Digital Input takes precedence. Digital Inputs and Logic Gate outputs configured to turn on a Digital Output have the same priority. These operate as an OR function with one another. The Digital Output will be active if either the Digital Input or the Gate Output is in a TRUE condition. If the controller is in Communications Slave mode on either loop. then the switches are disabled.
	NONE	**NO DIGITAL INPUT SELECTIONS**
	TO MAN	**TO MANUAL** — Contact closure puts the controller into manual mode.
	TO SP1	**TO LOCAL SETPOINT** — Contact closure puts the controller into local setpoint 1.
	TO SP2	**TO LOCAL SETPOINT TWO** — Contact closure puts the controller into local setpoint 2.
	TO SP3	**TO LOCAL SETPOINT THREE** — Contact closure puts the controller into local setpoint 3.
	TO DIRECT	**TO DIRECT ACTION** — Contact closure selects direct controller action.
	TO HOLD	**TO HOLD** — Contact closure suspends Setpoint Ramp. Contact open runs ramp.
	TO PID2	**TO PID2** — Contact closure selects PID Set 2.
	PV IS IN2	**PV = INPUT 2**-Contact Closure selects PV = Input 2.
	PV IS IN3	**PV = INPUT 3**-Contact Closure selects PV = Input 3.
	PV IS IN4	**PV = INPUT 4**-Contact Closure selects PV = Input 4.
	PV IS IN5	**PV = INPUT 5**-Contact Closure selects PV = Input 5.
	TO RUN	**RUN** — Contact closure starts a stopped SP RAMP.
	TRACK 1	**OUTPUT 1 TRACKS INPUT 4** — Contact closure allows OUT 1 to track Input 4.

Table 4-12 continued on next page

Table 4-12 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DIG IN 1 continued	TRACK 2	**OUTPUT2 TRACKS INPUT 4** — Contact closure allows OUT 2 to track Input 4.
	TO OUT 2	**OUT 2 OVERRIDES OUTPUT 1** — Allows OUT 2 to override OUT 1.
	MAN SAFE	**MANUAL FAILSAFE –** Unit goes to Manual Mode, output goes to the Failsafe value.
	PULSE DOWN	**SETPOINT DOWN** — Contact closure selects downward direction of setpoint when Pulse Input is used as a setpoint adjustment. Open Contact selects Upward direction.
	OUT 3 ON	**OUTPUT 3 ON** — Contact closure energizes Output 3. This selection is overridden by Time Proportioning Output selections and Alarm 3.
	OUT 4 ON	**OUTPUT 4 ON** — Contact closure energizes Output 4. This selection is overridden by Time Proportioning Output selections and Alarm 4.
	INHIBIT 1	**INHIBITS INTEGRAL ACTION** — Contact Closure inhibits integral action on PID-A or PID-B algorithms.
	TO RSP	**TO REMOTE SETPOINT** — Contact closure selects the Remote Setpoint.
	DSP L1/L2	**LOOP DISPLAY** — Contact closure displays loop not currently being displayed. Opening contact returns to original loop display.
	RESET FB	**INTEGRAL RESET OVERRIDE -** Contact closure allows Input 3 to override the Integral Reset Calculation. Note: Input 3 Ratio and Bias settings are ignored and should be set to 1.00 and 0.00 to make the value consistent with the front display readout. The value used is in percent of the range.
	ToA/M STA	**TO AUTO MANUAL STATION -** When the switch is closed, the loop performs as follows: PV = In2 Action = Direct Control Algorithm = PD+MR PIDSET = 2 SP = LSP2
	TO PURGE	**TO PURGE -** When the switch is closed, the loop is forced to Manual mode with the Output value set to the *High Output Limit*. The configuration of the Latching function determines whether the action is momentary or latching.
	LOW FIRE	**TO LOW FIRE -** When the switch is closed, the loop is forced to Manual mode with the Output value set to the *Low Output Limit*. The configuration of the Latching function determines whether the action is momentary or latching.
	ToTUNE	**ToTUNE -** contact closure starts the tuning process**.**

Table 4-12 continued on next page

Table 4-12 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DIG 1 COMB		**DIGITAL INPUT 1 COMBINATIONS** - These selections can be used with any selection from DIG IN1.
	DISABLE	**DISABLE** - Disables combination function.
	+ To PID2	ANY DIGITAL INPUT SELECTION PLUS **TO PID SET TWO** – Contact closure puts the controller into PID SET 2.
	+ To DIR	ANY DIGITAL INPUT SELECTION PLUS **TO DIRECT CONTROL** – Contact closure puts the controller into DIRECT CONTROL.
	+ToSP2	ANY DIGITAL INPUT SELECTION PLUS **TO LOCAL SETPOINT TWO** — Contact closure puts the controller into local setpoint 2.
	ADT1	ANY DIGITAL INPUT SELECTION PLUS **DISABLE ADAPTIVE TUNE**— Contact closure disables Adaptive Tune on Loop 1.
	+ToSP1	ANY DIGITAL INPUT SELECTION PLUS **TO LOCAL SETPOINT ONE** — Contact closure puts the controller into local setpoint 1.
	To RUN	ANY DIGITAL INPUT SELECTION PLUS **RUN SETPOINT RAMP** — Contact closure switches to RUN if Setpoint Ramp.
DIG IN 2		**DIGITAL INPUT TWO SELECTIONS** — Same selections as DIG IN1. Digital Input 2 is reserved for Loop 2 parameters when Two Loops or Internal Cascade is configured.
DIG 2 COMB		**DIGITAL INPUT 2 COMBINATIONS** - These selections can be used with any selection from **DIG IN2**.

Table 4-12 continued on next page

Table 4-12 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DIG IN 3		**DIGITAL INPUT THREE SELECTIONS** — Digital Input 3 is internally connected (shares rear terminals) with the Alarm1 and Digital Output 1. The controller returns to its original state when contact opens, except where noted. If the selection for the Digital Inputs are in conflict with each other, whichever switch is closed first will take precedence. If multiple switches are closed simultaneously, then the lowest numbered Digital Input takes precedence. Digital Inputs and Logic Gate outputs configured to turn on a Digital Output have the same priority. These operate as an OR function with one another. The Digital Output will be active if either the Digital Input or the Gate Output is in a TRUE condition. If the controller is in Communications Slave mode on either loop, then the switches are disabled. Contact closure enables one of the following:
	NONE	**NO DIGITAL INPUT SELECTIONS**
	TO MANUAL	**TO MANUAL** — Contact closure puts the controller into manual mode.
	TO SP1	**TO LOCAL SETPOINT** — Contact closure puts the controller into local setpoint 1.
	TO SP2	**TO LOCAL SETPOINT TWO** — Contact closure puts the controller into local setpoint 2.
	TO SP3	**TO LOCAL SETPOINT THREE** — Contact closure puts the controller into local setpoint 3.
	TO RUN	**TO RUN**— Contact closure starts a Setpoint ramp.
	TO HOLD	**TO HOLD** — Contact closure suspends Setpoint Ramp. Contact open runs ramp.
	TO PID2	**TO PID2** — Contact closure selects PID Set 2.
	PV IS IN1	**PV = INPUT 1**-Contact Closure selects PV = Input 1.
	PV IS IN2	**PV = INPUT 2**-Contact Closure selects PV = Input 2.
	PV IS IN3	**PV = INPUT 3**-Contact Closure selects PV = Input 3.
	PV IS IN4	**PV = INPUT 4**-Contact Closure selects PV = Input 4.
	PV IS IN5	**PV = INPUT 5**-Contact Closure selects PV = Input 5.
	RSP - IN1	**REMOTE SETPOINT FROM INPUT 1**— Contact closure selects Input 1 as the Remote Setpoint.

Table 4-12 continued on next page

Table 4-12 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DIG IN 3 continued	RSP - IN2	**REMOTE SETPOINT FROM INPUT 2**— Contact closure selects Input 2 as the Remote Setpoint.
	RSP - IN3	**REMOTE SETPOINT FROM INPUT 3**— Contact closure selects Input 3 as the Remote Setpoint.
	RSP - IN4	**REMOTE SETPOINT FROM INPUT 4**— Contact closure selects Input 4 as the Remote Setpoint.
	RSP - IN5	**REMOTE SETPOINT FROM INPUT 5**— Contact closure selects Input 5 as the Remote Setpoint.
	TO DIRECT	**TO DIRECT ACTION** — Contact closure selects direct controller action.
	MAN SAFE	**MANUAL FAILSAFE –** Unit goes to Manual Mode, output goes to the Failsafe value.
	ToA/M STA	**TO AUTO MANUAL STATION -** When the switch is closed, the loop performs as follows: PV = In2 Action = Direct Control Algorithm = PD+MR PIDSET = 2 SP = LSP2
	TO PURGE	**TO PURGE -** When the switch is closed, the loop is forced to Manual mode with the Output value set to the *High Output Limit*. The configuration of the Latching function determines whether the action is momentary or latching.
	LOW FIRE	**TO LOW FIRE -** When the switch is closed, the loop is forced to Manual mode with the Output value set to the *Low Output Limit*. The configuration of the Latching function determines whether the action is momentary or latching.
DIG IN 4		**DIGITAL INPUT FOUR SELECTIONS** — Digital Input 4 is internally connected (shares rear terminals) with the Alarm 2 and Digital Output 2. **Same selections as DIG IN3**.
DIG IN 5		**DIGITAL INPUT FIVE SELECTIONS** — Digital Input 5 is internally connected (shares rear terminals) with Digital Output 3 which can be used by: • Loop 1 Time Proportioning - Heat Output • Alarm 3 • Logic Gates Any use of these outputs will also trigger this Digital Input. **Same selections as DIG IN3**.

Continued on next page

Table 4-12 Option Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DIG IN 6		**DIGITAL INPUT SIX SELECTIONS** — Digital Input 6 is internally connected (shares rear terminals) with Digital Output 4 which can be used by: • Loop 1 Time Duplex - Cool Output • Loop 2 Time Simplex Output • Alarm 4 • Logic Gates Any use of these outputs will also trigger this Digital Input. **Same selections as DIG IN3**.
DI ON LP1		**LOOP 1 ASSIGNMENT**— When 2 Loops are configured, Digital Inputs 3 to 6 are assigned to Loop 1 according to your selection below. *Unassigned Digital Inputs are assigned to Loop 2 by default*.
	DI3,4,5,6	Assign all Digital Inputs to Loop 1.
	DI3,4,5	Assign Digital Inputs 3, 4, and 5 to Loop 1.
	DI3,4	Assign Digital Inputs 3 and 4 to Loop 1.
	DI3	Assign Digital Input 3 to Loop 1.
LATCHING		
	NONE	**NONE** — The resulting action of the DI configured as TO PURGE or LOW FIRE is momentary, that is, the action is active only during the duration of the DI being closed, which forces the loop to Manual mode with the output being at either High or Low Output Limit.
	PURGE	**PURGE** — The resulting action of the DI being closed is that the loop is forced to Manual mode with the output value set to the High Output Limit. The loop is latched and can only be returned to Automatic mode by pressing the MAN/AUTO key on the front panel.
	LOW FIRE	**LOW FIRE** — The resulting action of the DI being closed is that the loop is forced to Manual mode with the output value set to the Low Output Limit. The loop is latched and can only be returned to Automatic mode by pressing the MAN/AUTO key on the front panel.
	BOTH	**BOTH** — The DI configured as either PURGE or LOW FIRE will cause latching to work as described under PURGE and LOW FIRE above.

4.14 Communications Set Up Group

Introduction

This option allows the controller to be connected to a host computer by way of various communications options.

The controller looks for messages from the computer at regular intervals. If these messages are not received within the configured shed time, the controller will SHED from the communications link and return to stand alone operation.

The device address, parity, baud rate, Computer Setpoint, Units, Ratio, and Bias are configurable *depending on the protocol* you are using.

You can also set the SHED output mode and setpoint recall, and communication units.

Up to 99 addresses can be configured over this link.

485TDC option
Up to four RS485 link addresses are allowed when the communication option is selected as 485TDCSDI. One PV Point and one OP point are required to be configured **per loop** when the UDC6300 TDC integration schematics are to be used for Operator Interface from the TDC Universal Station. Remote Cascade Option and overall mode of Operation can also be configured.

Communications group prompts

Table 4-13 lists all the function prompts in the Communications setup group and their definitions.

Table 4-13 Communications Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
COM STATE	DISABL 485DMCS 422ASCII 485MODRTU 485TDCSDI 485BSAP	**COMMUNICATIONS SELECTION** **DISABL** — Disables the communications option. **DMCS** — Enables DMCS communication. **422ASCII** — Enables RS422/485 communication. **485RTU** — Enables Modbus 485RTU communication. **485TDC** — Allows the UDC6300 to communicate with the TDC3000. **485BSAP** — Bristol Protocol
ADDRESS *485DMCS, 422ASCII, 485MODRTU, 485BSAP only*	1 to 99	**COMMUNICATIONS STATION ADDRESS** (LOOP 1) — This is a number that is assigned to a controller that is to be used with the communications option. This number will be its address. Must be different addresses for 2 Loops on 485ASCII.
ADDRESS2 *485ASCII only*	1 to 99	**COMMUNICATIONS STATION ADDRESS** (LOOP 2) — This is a number that is assigned to a controller that is to be used with the communications option. This number will be its address. Must be different addresses for 2 Loops on 485ASCII.

Table 4-13 continued on next page

Table 4-13 Communications Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
PV1 SLOT *485TDCSDI only*	0 to 16 0=No Connection	**LOOP 1 PROCESS VARIABLE (PV) POINT ADDRESS** — Select the RS485 slot that corresponds to the TDC SDI IOP point that will be used to access UDC Loop 1 Process Variable (PV) data. Recommended 485TDCSDI slots: FTA1 = SDI/IOP POINT 1 TO 8 FTA2 = SDI/IOP POINT 9 TO 16 This will map the UDC 485 slots directly to the IOP point numbers. Do not mix higher slots (9 to 16) with lower slots (1 to 8) on UDCs that will be connected to a single FTA.
OP1 SLOT *485TDCSDI only*	0 to 16 0=No Connection	**LOOP 1 OUTPUT (OP) POINT ADDRESS** — Select the RS485 slot that corresponds to the TDC SDI IOP point that will be used to access UDC Loop 1 Output (OP) data. Recommended 485TDCSDI slots: FTA1 = SDI/IOP POINT 1 TO 8 FTA2 = SDI/IOP POINT 9 TO 16 This will map the UDC 485 slots directly to the IOP point numbers. Do not mix higher slots (9 to 16) with lower slots (1 to 8) on UDCs that will be connected to a single FTA.
PV2 SLOT *485TDCSDI only*	0 to16 0=No Connection	**LOOP 2 PROCESS VARIABLE (PV) POINT ADDRESS** — Select the 485TDCSDI address that corresponds to the TDC SDI IOP point that will be used to access UDC Loop 2 Process Variable (PV) data. See “PV1 SLOT”.
OP2 SLOT *485TDCSDI only*	0 to 16 0=No Connection	**LOOP 1 OUTPUT (OP) POINT ADDRESS** — Select the 485TDCSDI address that corresponds to the TDC SDI IOP point that will be used to access UDC Loop 2 Output (OP) data. See “OP1 SLOT”.
PARITY *485ASCII only*	ODD EVEN	**PARITY** pertains to the use of a self-checking code employing binary digits in which the total number of ONE's (or ZERO's) in each permissible code expression is either ODD or EVEN. **ODD PARITY** **EVEN PARITY**
BAUD RATE *Does not apply to 485TDCSDI*	300 600 1200 2400 4800 9600 19200 38400	**BAUD RATE** is the transmission speed in bits per second. **300 BAUD** **600 BAUD** **1200 BAUD** **2400 BAUD** **4800 BAUD** **9600 BAUD** **19200 BAUD** **38400 BAUD** **NOTE: If you make a change in Baud Rate, cycle the power supply after you make the change.**

Table 4-13 continued on next page

Table 4-13 Communications Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
FRAMING *422ASCII, 485MODRTU only*		**FRAMING** —Used with asynchronous block communication including ASCII and Modbus RTU. This prompt allows selection of maximum allowable time between transmitted characters before the received message is terminated. Typically, this parameter should be set to DEFAULT, but additional adjustment may be required when the Host (PC) communication driver has gaps that exceed the normal allowable delay.
	DEFAULT	**DEFAULT Modbus** framing is based on the baud rate as 3-1/2 character times. **DEFAULT ASCII** framing is infinite time delay between characters. Messages are only terminated when a LF,CR is received.
	100MSEC 50MSEC 25MSEC 10MSEC	**100MSEC**—100 milliseconds **50MSEC**—50 milliseconds **25MSEC**—25 milliseconds **10MSEC**—10 milliseconds
XMT DELAY		**TRANSMISSION DELAY**—Provides a means for delaying the response from the UDC after a valid message has been received. It allows hot computers that operate in half duplex to post a receive after the end of a transmission. It is also used in cases where the two wire RS232/485 adapter requires a delay for shutting down its drivers after transmission.
	NONE 10MSEC 20MSEC 30MSEC 40MSEC 50MSEC	**NONE**—No transmission delay **10MSEC**—10 milliseconds **20MSEC**—20 milliseconds **30MSEC**—30 milliseconds **40MSEC**—40 milliseconds **50MSEC**—50 milliseconds
DUPLEX *Does not apply to 485TDCSDI*	 HALF FULL	**DUPLEX –** Transmission Response **HALF** — Delayed Response **FULL** — No Delayed Response
DATA FORM *485MODRTU only*	 INTEGER FLOAT PT	**DATA FORM** — Transmission Data Format **INTEGER** — Process-related data in 16-bit Integer format **FLOAT PT** — Process-related data in IEEE Floating Point format
UNITS		**COMMUNICATION UNITS** — This selection determines how the controller values are expressed during communications.
	PERCNT ENG	**PERCENT OF SPAN** **ENGINEERING UNITS**

Table 4-13 continued on next page

Table 4-13 Communications Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
BOX MODE	Overall Mode of UDC6300 Operation BASIC FULL	**BOX MODE** — You can set the overall mode of operation which will determine the level of interaction allowed from the TDC to the UDC6300. **BASIC MODE** — Permits only monitor operation from the TDC. **FULL MODE** — Permits control operations including mode changes and Output and Setpoint overrides.
SHEDTIME	1 to 255	**SHED TIME** — The number that represents how many sample periods there will be before the controller sheds from communications. Each period equals 1/3 second or 0 = No shed.
SHEDMODE	 LAST TO MAN FSAFE ToAUTO	**SHED CONTROLLER MODE AND OUTPUT LEVEL FOR LOOP 1** — Determines the mode of local control you want when the controller is shed from the communications link. **LAST** — SAME MODE AS BEFORE SHED — The controller will return to the same mode (manual or automatic) that it was in before shed. **TO MAN** — TO MANUAL MODE BUMPLESS OUTPUT — The controller will return to manual mode at the same output level that it had before shed. **FAILSAFE** — TO MANUAL MODE, FAILSAFE OUTPUT — The controller will return to manual mode at the output value selected at “CONTROL” prompt “FAILSAFE”. **ToAUTO** — To automatic mode.
SHED SP	 TO LSP TO CSP	**SHED SP FOR LOOP 1** — Shed setpoint recall. **TO LSP** — Controller will use last local SP used. **TO CSP** — Controller will use computer setpoint.
CSP RATIO	–20.00 to 20.00	**LOOP 1 COMPUTER SETPOINT RATIO** — Computer Setpoint ratio for Loop 1.
CSP BIAS	–999.0 to 9999	**LOOP 1 COMPUTER SETPOINT BIAS** — Computer Setpoint Bias for Loop 1.
RCASMODE *485TDCSDI only*	 SPC DDC M/A STN	**REMOTE CASCADE OPTION FOR LOOP 1** — Lets you select a Remote Cascade control architecture. **SPC (Supervisory Control) —** The setpoint of the secondary controller is controlled by a higher level (Primary) controller. **DDC (Direct Digital Control)** — The Output of the secondary controller is controlled by the Output of the higher level (Primary) controller. **MANUAL AUTO STATION**—Allows the control loop to behave as a Manual Auto Station whereby only manual control is available at the UDC and Auto control is performed in a computer or PLC.

Table 4-13 continued on next page

Table 4-13 Communications Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
SHED2MODE	 LAST TO MAN FSAFE ToAUTO	**SHED CONTROLLER MODE AND OUTPUT LEVEL FOR LOOP 2** — Determines the mode of local control you want when the controller is shed from the communications link. **LAST** — SAME MODE AS BEFORE SHED — The controller will return to the same mode (manual or automatic) that it was in before shed. **TO MAN** — TO MANUAL MODE BUMPLESS OUTPUT — The controller will return to manual mode at the same output level that it had before shed. **FSAFE** — TO MANUAL MODE, FAILSAFE OUTPUT — The controller will return to manual mode at the output value selected at “CONTROL” prompt “FAILSAFE”. **ToAUTO** — To automatic mode.
SHED2SP	 TO LSP TO CSP	**SHED SP FOR LOOP 2** — Shed setpoint recall. **TO LSP** — Controller will use last local SP used. **TO CSP** — Controller will use computer setpoint.
CSP2 RATIO	–20.00 to 20.00	**LOOP 2 COMPUTER SETPOINT RATIO** — Computer Setpoint Ratio for Loop 2.
CSP2 BIAS	–999.0 to 9999	**LOOP 2 COMPUTER SETPOINT BIAS** — Computer Setpoint Bias for Loop 2.
RCAS2MOD *485TDCSDI only*	 SPC DDC M/A STN	**REMOTE CASCADE OPTION FOR LOOP 2** — Lets you select a Remote Cascade control architecture. **SPC (Supervisory Control)** — The setpoint of the secondary controller is controlled by a higher level (Primary) controller. **DDC (Direct Digital Control)** — The Output of the secondary controller is controlled by the Output of the higher level (Primary) controller. **MANUAL AUTO STATION**—Allows the control loop to behave as a Manual Auto Station whereby only manual control is available at the UDC and Auto control is performed in a computer or PLC.
TESTCOM *(replaces LOOPBACK)*	ENABLE DISABL	**TEST COMMUNICATIONS**—When enabled, causes the UDC to transmit a protocol-oriented broadcast message. It is useful for ensuring the device is connected properly and that its Baud Rate, Parity, and communication type are compatible with the host computer. For Modbus, TDC, and DMCS, the message is: <AA> 41 04 FF 55 AA <CRC> *where:* AA is an 8-bit address <CRC> is a 16-bit cyclical redundancy check For ASCII, the message is: <AA>,0204,04,FF,55,AA,<CR><LF> *where:* AA is the device address <CR>,<LF> are carriage return, line feed end of string indication

4.15 Alarms Set Up Group

Introduction

An alarm is an indication that an event that you have configured (for example—Process Variable) has exceeded one or more alarm limits. There are up to four alarms available. Each alarm has two setpoints. You can configure each of these two setpoints to alarm on various controller parameters.

There are two alarm output selections, High and Low. You can configure each setpoint to alarm either High or Low.

Latching or Non-Latching alarms are available.
Alarm 1 = Digital Output 1
Alarm 2 = Digital Output 2
Alarm 3 = Digital Output 3 if not used for Control Output i.e Dedicated
Alarm 4 = Digital Output 4 if not used for Control Output i.e Dedicated

Alarms group prompts

Table 4-14 lists all the function prompts in the Alarms setup group and their definitions.

Table 4-14 Alarms Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A1S1 VALU*	Value in Engineering Units	**ALARM 1 SETPOINT 1 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A1S1TYPE" to actuate. The value depends on what the setpoint has been configured to represent.
A1S2 VALU*	Value in Engineering Units	**ALARM 1 SETPOINT 2 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A1S2TYPE" to actuate. The details are the same as “A1S1 VALU”.
A2S1 VALU*	Value in Engineering Units	**ALARM 2 SETPOINT 1 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A2S1TYPE" to actuate. The details are the same as “A1S1 VALU”.
A2S2 VALU*	Value in Engineering Units	**ALARM 2 SETPOINT 2 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A2S2TYPE" to actuate. The details are the same as “A1S1 VALU”.

• AxSxVALU is not available for AxSx TYPE: NONE, SHED, MANUAL, MANUAL2, REMSP, REMSP2, FAILSAFE, FAILSAFE2.

Table 4-14 continued on next page

Table 4-14 Alarms Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A3S1 VALU*	Value in Engineering Units	**ALARM 3 SETPOINT 1 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A3S1TYPE" to actuate. The value depends on what the setpoint has been configured to represent.
A3S2 VALU*	Value in Engineering Units	**ALARM 3 SETPOINT 2 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A3S2TYPE" to actuate. The details are the same as "A1S1 VALU".
A4S1 VALU*	Value in Engineering Units	**ALARM 4 SETPOINT 1 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A4S1TYPE" to actuate. The details are the same as "A1S1 VALU".
A4S2 VALU*	Value in Engineering Units	**ALARM 4 SETPOINT 2 VALUE** — This is the value at which you want the alarm type chosen in Prompt "A4S2TYPE" to actuate. The details are the same as "A1S1 VALU".
A1S1TYPE		**ALARM 1 SETPOINT 1 TYPE** — Select what you want Setpoint 1 of Alarm 1 to represent.
	NONE INPUT 1 INPUT 2 INPUT 3 INPUT 4 INPUT 5	**NO ALARM** **INPUT 1** **INPUT 2** **INPUT 3** **INPUT 4** **INPUT 5**
	PV DEVIATION OUTPUT SHED	**PROCESS VARIABLE** **DEVIATION** **OUTPUT** **SHED FROM COMMUNICATIONS**
	PV2 DEV2 OUTPUT2	**CONTROL LOOP 2 PV** **CONTROL LOOP 2 DEVIATION** **CONTROL LOOP 2 OUTPUT**
	MANUAL MANUAL2 REM SP REM SP2 FAILSAFE FAILSAFE2	**ALARM ON LOOP 1 MANUAL** **ALARM ON LOOP 2 MANUAL** **ALARM ON LOOP 1 REMOTE SETPOINT** **ALARM ON LOOP 2 REMOTE SETPOINT** **ALARM ON LOOP 1 FAILSAFE** **ALARM ON LOOP 2 FAILSAFE** **ATTENTION** When the Alarm type is re-configured, the value of the current alarm setpoint does not automatically change to be consistent with the range of the new alarm type until it is viewed on the display.

• AxSxVALU is not available for AxSx TYPE: NONE, SHED, MANUAL, MANUAL2, REMSP, REMSP2, FAILSAFE, FAILSAFE2.

Table 4-14 Alarms Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A1S2TYPE	Same as A1S1 TYPE	**ALARM 1 SETPOINT 2 TYPE** — Select what you want Setpoint 2 of Alarm 1 to represent. The selections are the same as A1S1TYPE.
A2S1TYPE	Same as A1S1 TYPE	**ALARM 2 SETPOINT 1 TYPE** — Select what you want Setpoint 1 of Alarm 2 to represent. The selections are the same as A1S1TYPE.
A2S2TYPE	Same as A1S1 TYPE	**ALARM 2 SETPOINT 2 TYPE** — Select what you want Setpoint 2 of Alarm 2 to represent. The selections are the same as A1S1TYPE.
A3S1TYPE	Same as A1S1 TYPE	**ALARM 3 SETPOINT 1 TYPE** — Select what you want Setpoint 1 of Alarm 3 to represent. The selections are the same as A1S1TYPE.
A3S2TYPE	Same as A1S1 TYPE	**ALARM 3 SETPOINT 2 TYPE** — Select what you want Setpoint 2 of Alarm 3 to represent. The selections are the same as A1S1TYPE.
A4S1TYPE	Same as A1S1 TYPE	**ALARM 4 SETPOINT 1 TYPE** — Select what you want Setpoint 1 of Alarm 4 to represent. The selections are the same as A1S1TYPE.
A4S2TYPE	Same as A1S1 TYPE	**ALARM 4SETPOINT 2 TYPE** — Select what you want Setpoint 2 of Alarm 4 to represent. The selections are the same as A1S1TYPE.
A1S1 H L*	 H I LO	**ALARM 1 SETPOINT 1 STATE** — Select whether you want the alarm type chosen in Prompt "A1S1TYPE" to alarm HIGH or LOW. **HI ALARM** **LO ALARM**
A1S2 H L*	 H I LO	**ALARM 1 SETPOINT 2 STATE** — Select whether you want the alarm type chosen in Prompt "A1S2TYPE" to alarm HIGH or LOW. **HI ALARM** **LO ALARM**
A2S1 H L*	 H I LO	**ALARM 2 SETPOINT 1 STATE** — Select whether you want the alarm type chosen in Prompt "A2S1TYPE" to alarm HIGH or LOW. **HI ALARM** **LO ALARM**
A2S2 H L*	 H I LO	**ALARM 2 SET POINT 2 STATE** — Select whether you want the alarm type chosen in Prompt "A2S2TYPE" to alarm HIGH or LOW. **HI ALARM** **LO ALARM**

Table 4-14 continued on next page

Table 4-14 Alarms Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
A3S1 H L*	 H I LO	**ALARM 3 SETPOINT 1 STATE** — Select whether you want the alarm type chosen in Prompt "A3S1TYPE" to alarm HIGH or LOW. **HI ALARM** **LO ALARM**
A3S2 H L*	 H I LO	**ALARM 3 SETPOINT 2 STATE** — Select whether you want the alarm type chosen in Prompt "A3S2TYPE" to alarm HIGH or LOW. **HI ALARM** **LO ALARM**
A4S1 H L*	 H I LO	**ALARM 4 SETPOINT 1 STATE** — Select whether you want the alarm type chosen in Prompt "A4S1TYPE" to alarm . **HI ALARM** **LO ALARM**
A4S2 H L*	 H I LO	**ALARM 4SET POINT 2 STATE** — Select whether you want the alarm type chosen in Prompt "A4S2TYPE" to alarm HIGH or LOW. **HI ALARM** **LO ALARM**
AL HYST	0.0 to 5.0% of span or full output as appropriate	**ALARM HYSTERESIS** — A single adjustable hysteresis is provided on alarms such that when the alarm is OFF it activates at exactly the alarm setpoint; when the alarm is ON, it will not deactivate until the variable is 0.0% to 5.0% away from the alarm setpoint. Configure the hysteresis of the alarms based on INPUT signals as a % of input range span. Configure the hysteresis of the alarm based on OUTPUT signals as a % of the full scale output range.
ALM ACTN	 ENERGIZE DE ENERGZ	**ALARM RELAY COIL ACTION -** The alarm action is configurable for normally de-energized (Reverse) operation. ENERGIZE - Digital Output energized on alarm. DE ENERGZ - Digital Output de-energized on alarm.

• *AxSxHL is not available for AxSx TYPE: NONE, SHED, MANUAL, MANUAL2, REMSP, REMSP2, FAILSAFE, FAILSAFE2.*

Continued on next page

Table 4-14 Alarms Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
ALM OUT 1	NON LATCH LATCHING	**LATCHING ALARM FOR OUTPUT 1 -** each alarm output can be configured to be "Latching" or "Non-latching". **Table 4-15 shows you the operation of the Digital Outputs, Annunciators, and Bargraphs when you select "Latching" or "Non-latching" alarms.**
ALM OUT 2	NON LATCH LATCHING	**LATCHING ALARM FOR OUTPUT 2 -** each alarm output can be configured to be "Latching" or "Non-latching".
ALM OUT 3	NON LATCH LATCHING	**LATCHING ALARM FOR OUTPUT 3 -** each alarm output can be configured to be "Latching" or "Non-latching".
ALM OUT 4	NON LATCH LATCHING	**LATCHING ALARM FOR OUTPUT 4 -** each alarm output can be configured to be "Latching" or "Non-latching".

Table 4-15 Latching and Non-latching Alarm Configuration

Alarm Configuration	Alarm Condition	Alarm ACK Key Pressed	Digital Outputs EN*	Digital Outputs DEN**	Annunciators ***	Bargraphs
Non Latching	STILL EXISTS	NO	ON	OFF	FLASHING	FLASHING
		YES	ON	OFF	ON	NORMAL
	ENDED	NO	OFF	ON	OFF	NORMAL
		YES	OFF	ON	OFF	NORMAL
Latching****	STILL EXISTS	NO	ON	OFF	FLASHING	FLASHING
		YES	ON	OFF	ON	NORMAL
	ENDED	NO	ON	OFF	FLASHING	FLASHING
		YES	OFF	ON	OFF	NORMAL

* "EN" is the "Digital Outputs Energized on Alarm" configuration
** "DEN" is the "Digital Outputs De-energized on Alarm" configuration
*** Only the Annunciator associated with the alarm will flash.
**** For CE conformity, Performance Criterion A, select “NON-LATCHING”.

4.16 Display Parameters Set Up Group

Introduction

This group contains selections for Decimal Place, Units of Temperature, Power Frequency, and Process I.D.

Alarms group prompts

Table 4-16 lists all the function prompts in the Display setup group and their definitions.

Table 4-16 Display Group Definitions

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
DECIMAL	XXXX XXX.X XX.XX X.XXX	**DECIMAL POINT LOCATION** — This selection determines where the decimal point appears in the display. **XXXX -** No Decimal Place **XXX.X -** One Place **XX.XX -** Two Places **X.XXX -** Three Places **ATTENTION** Auto-ranging will occur to whichever decimal place has been selected.
DECIMAL2	XXXX XXX.X XX.XX X.XXX	**CONTROL LOOP 2 DECIMAL POINT LOCATION** — This selection determines where the decimal point appears in the display for Loop 2. **XXXX -** No Decimal Place **XXX.X -** One Place **XX.XX -** Two Places **X.XXX -** Three Places
TEMP UNIT	DEG F DEG C NONE	**TEMPERATURE UNITS -** This selection will affect the indication and operation. Applies to Loop 1. **DEG F -** Degrees Fahrenheit **DEG C -** Degrees Centigrade **NONE -** No display of units
PWR FREQ	60HZ 50HZ	**POWER FREQUENCY -** Select whether your controller is operating at 50 or 60 Hertz.
SPGRAPH	FULL ONE BAR	**SETPOINT BARGRAPH INDICATION -** This selection affects how the setpoint bargraph will operate. Only available if 2LOOP DIS is configured for SPnPVnON. **FULL -** all bars light up to indicate setpoint value **ONE BAR -** one bar lights at the setpoint value.

Table 4-16 continued on next page

Table 4-16 Display Group Definitions, continued

Lower Display Prompt	Upper Display Range of Setting or Selection	Parameter Definition
2 LOOP DIS		**BARGRAPH DISPLAY -** What the bargraphs represent depends on the selection you make at this prompt.
	SPnPVnOn	**SPnPVnOn -** *Left bargraph* Indicates setpoint of Loop selected *Center bargraph* Indicate PV of same Loop *Right bargraph* Indicates Output of same Loop
	L1 L2 On	**L1 L2 On -** *Left bargraph* Indicates Loop 1 PV as a column of bars -- SP is a Blinking bar *Center bargraph* Indicates Loop 2 PV as a column of bars -- SP is a Blinking bar *Right bargraph* Indicates Output of Loop selected as shown by L1 or L2 digital display
	L1 - - On	**L1 - - On** *Left bargraph* Same as above *Center bargraph* Blank *Right bargraph* Same as above (Out 1 or Out 2)
	- - L2 On	**- - L2 On** *Left bargraph* Blank *Center bargraph* Indicates Loop 2 PV as a column of Bars -- SP is a single blinking Bar *Right bargraph* Same as above (Out 1 or Out 2)
ID TAG	ENABLE DISABLE	**PROCESS IDENTIFICATION TAG -** A nine character alphanumeric tag. This tag can be configured to display almost any message. It is displayed in the lower digital display and accessed by the LOWR DISP key. Entry selections listed in prompt “TAG”.
PVTAG	ENABLE DISABLE	**PROCESS VARIABLE TAG -** A three character alphanumeric tag in the upper display. This tag can be configured to display messages such as : GPH, CFM, PSI, DEG, or others. Entry selections listed in prompt "TAG".
PVTAG2	ENABLE DISABLE	**PROCESS VARIABLE TAG 2 -** A three character alphanumeric tag in the upper display if "2 LOOPS" is selected at Algorithm prompt "PID LOOPS". Entry selections listed in prompt "TAG".

Table 4-16 continued on next page

Table 4-16 Display Group Definitions, continued

<table>
<tr><th>Lower Display
Prompt</th><th>Upper Display
Range of Setting
or Selection</th><th>Parameter
Definition</th></tr>
<tr><td>TAG
ID or PV tag
ConfigurationTag</td><td>Letters: A to Z
Numbers: 0 to 9
Others: <, >, #, /, \, |,
(blank), –, ., °, =,
?, _, ^,V, +, *PV</td><td>TAG - Use the ▲ or ▼ key to select entries.</td></tr>
<tr><td>RATIO 4SET</td><td>

DISABLE
LOWR DISP</td><td>INPUT 4 RATIO - this enables the Ratio for Input 4 to be set from the front panel.

DISABLE - Disables Ratio 4 set.
LOWR DISP - allows the Ratio for Input 4 to be set using the Lower Display key on the front of the operator interface.

Input 4 must be enabled for this to operate.</td></tr>
<tr><td>LANGUAGE</td><td>

ENGLISH
FRENCH
GERMAN</td><td>LANGUAGE- this selection designates the prompt language.

ENGLISH
FRENCH
GERMAN</td></tr>
</table>

4.17 Calibration Data

Introduction

The prompts used here are for field calibration purposes. Refer to *Section 6 – Input Calibration* in this manual for complete information.

4.18 Status Test Data

Introduction

The prompts used here are for determining the reason for a controller failure. Refer to the *Section 8 – Troubleshooting* in this manual for complete information.

Section 5 – Operation

5.1 Overview

Introduction

This section gives you all the information necessary to monitor and operate your controller. Review the Operator Interface shown in subsection 5.4 “Monitoring” to make sure you are familiar with the indicator definitions. The key functions are listed in *Section 1 - Overview.*

What’s in this section?

This section contains the following topics:

Topic		See Page
5.1	Overview	143
5.2	How to Power Up the Controller	144
5.3	How to Enter a Security Code	146
5.4	Monitoring Your Controller	147
5.5	Start-Up Procedure	153
5.6	Operating Modes	154
5.7	Setpoints	158
5.8	Setpoint Ramp Rate	165
5.9	Single Setpoint Ramp	166
5.10	Using Two Sets of Tuning Constants	169
5.11	2 Loops of Control Overview	172
5.12	Configure 2 loops of Control	177
5.13	Monitor 2 Loops of Control	180
5.14	Operate 2 Loops of Control	183
5.15	Input Math Algorithms	184
5.16	Logic Gate Operation	187
5.17	Digital Outputs/Alarms	189
5.18	Digital Input Option (Remote Switching)	192
5.19	Fuzzy overshoot Suppression	198
5.20	Accutune	199
5.21	Input 5 - Pulse Input	208
5.22	Three Position Step Control	210
5.23	Auto/Manual Station	212

5.2 How to Power Up The Controller

Apply power

When power is applied, the controller will run three diagnostic tests. All the displays will light and then the controller will go into automatic mode.

Diagnostic tests

Table 5-1 lists the three diagnostic tests.

Table 5-1 Power Up Diagnostic Tests

Prompt on Lower Display	Condition
RAM TEST	Checks RAM memory
CONFTEST	Checks the controller's software configuration for inconsistencies.
CAL TEST	Checks calibration of the controller's configured analog inputs and outputs.

Test failures

All the displays and indicators will light and then display "TEST DONE". If all these tests pass, the controller will function in a normal manner without any diagnostic messages.
If one or more of these tests fail while checking memory, the controller will go to the Fail-safe Manual Mode, and “FAILSAFE” will flash in the lower display.

Troubleshooting

Refer to “STATUS TESTS” in *Section 8- Troubleshooting* to identify and correct the problem.

Continued on next page

Check the displays and keys

Use the procedure in Table 5-2 to run the display and key test.

Table 5-2 Procedure for Testing the Displays and Keys

<table>
<tr><th>Press</th><th>Result</th></tr>
<tr><td>SET UP
and hold in,
then
FUNC L1/L2
at the same time</td><td>The controller will run a display test. All the displays will light for 8 seconds, then the displays will look like this:
Upper Display
KEYS
Lower Display
TRY ALL
You will have 60 seconds to test the keys.</td></tr>
<tr><td>Press each key to see if it works</td><td>When the key is pressed, the lower display will indicate the name of the key pressed.
<table>
<tr><th>Key Pressed</th><th>Lower Display</th></tr>
<tr><td>FUNC - L1/L2</td><td>FUNCTION</td></tr>
<tr><td>LOWR DISP</td><td>LOWR_DISP</td></tr>
<tr><td>MAN/AUTO</td><td>AUTO_MAN</td></tr>
<tr><td>SET UP</td><td>_SETUP</td></tr>
<tr><td>▲</td><td>INCREMENT</td></tr>
<tr><td>▼</td><td>DECREMENT</td></tr>
<tr><td>ALM ACK</td><td>ALARM_ACK</td></tr>
<tr><td>RSP/CAS</td><td>RSP_CASC</td></tr>
<tr><td>SP1/SP2</td><td>SP1_SP2</td></tr>
<tr><td>▲ + ▼</td><td>INCR_DECR</td></tr>
<tr><td>FUNC+SETUP</td><td>FUNC SU</td></tr>
<tr><td>FUNC + ▲</td><td>FUNC_INCR</td></tr>
</table>
</td></tr>
</table>

If no key is pressed for 20 seconds, the test will time out and the controller will go into control mode.

If any test fails, go to "Controller Failure Symptoms" in *Section 8 - Troubleshooting.*

Key error

When a key is pressed and the prompt "KEY ERROR" appears in the lower display, it will be for one of the following reasons:

- parameter not available,
- not in Set Up mode, press SET UP key first,
- Key malfunction, do keyboard test.

5.3 Enter a Security Code

Introduction

The LOCKOUT feature in the UDC6300 is used to inhibit changes (via keyboard) of certain functions or parameters by unauthorized personnel. There are different levels of LOCKOUT depending on the level of security required. These levels are:

NONE
CALIBRATE
+CONF
+VIEWING
MAXIMUM

See *Section 4 - Configuration Definitions* for details.

Security code numbers

The level of keyboard lockout may be changed in the Set Up mode. However, knowledge of a security code number (1 to 4095) may be required to change from one level of lockout to another.
When a controller leaves the factory, it has a security code of 0 which permits changing from one lockout level to another without entering any other code number.

Procedure

If you require the use of a security code, select a number from 0001 to 4095 and enter it when the lockout level is configured as "NONE". Thereafter, that selected number must be used to change the lockout level from something other than "NONE".

CAUTION Write the number on the Configuration Record Sheet in the configuration section so you will have a permanent record.

Use the procedure in Table 5-3 to enter a security code.

Table 5-3 Procedure for Entering a Security Code

Step	Press	Action
1	SET UP	Until you see Upper Display SET UP Lower Display TUNING
2	FUNC L1/L2	Until you see Upper Display 0 Lower Display SECURITY
3	▲ or ▼	to enter a four digit number in the upper display (0 to 4095) This will be your security code.

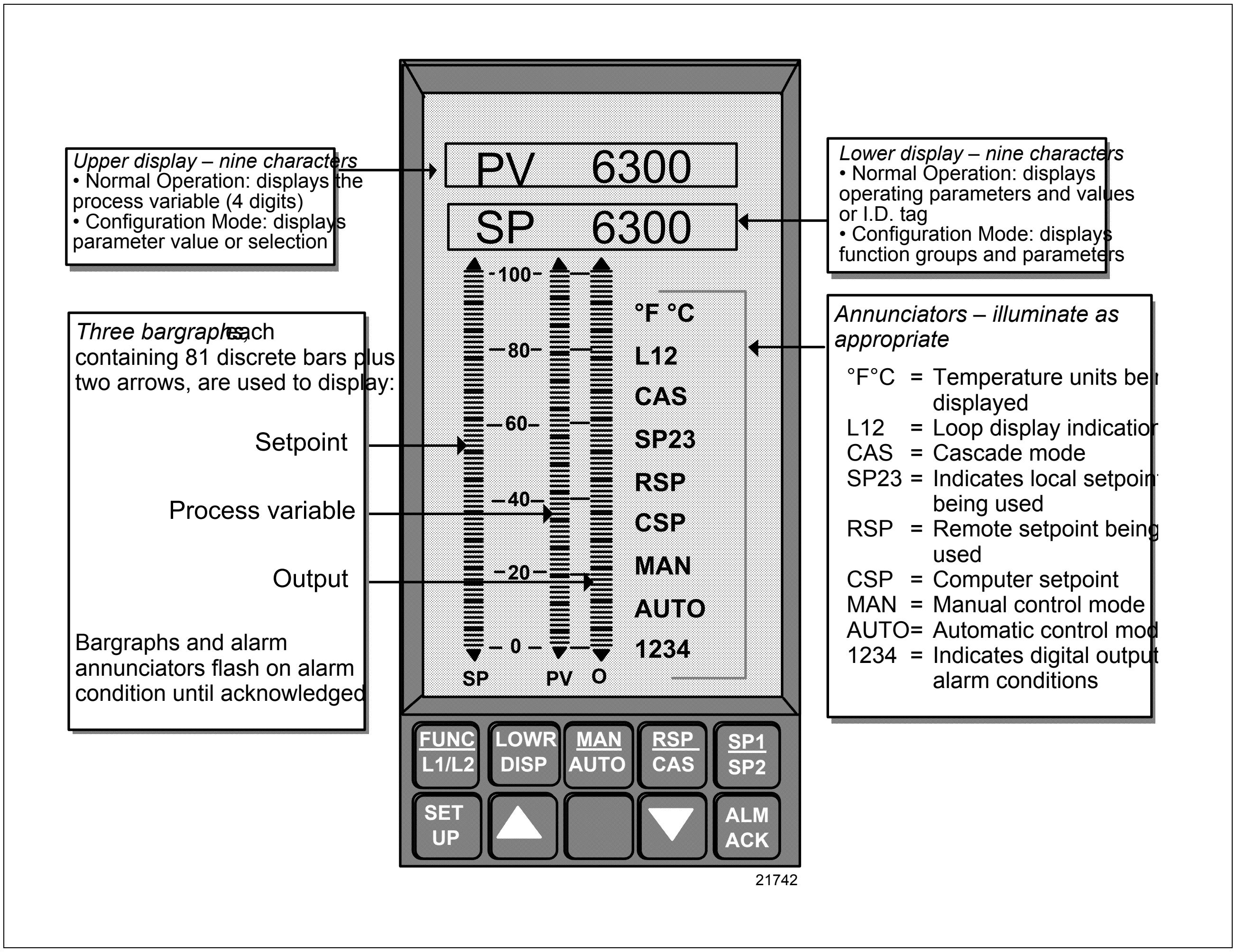
5.4 Monitoring Your Controller

Operator Interface

The indicators and displays on the Operator Interface let you see what is happening to your process and how the controller is responding.

Figure 5-1 is a view of the Operator interface. A description of the displays and indicators is included.

Figure 5-1 Operator Interface



Decimal point position

In each display, when no decimal place is configured, the right-most character is blank.

When a single decimal position has been configured and values greater than 1000 are displayed, the right-most character is blank but the decimal point will be lit.

Continued on next page

Annunciators

The following annunciator functions have been provided:

A visual indication of each Digital Output

1 2 3 4

A visual indication of the mode of the controller

AUTO - Automatic Mode
MAN - manual Mode

Annunciators showing the Control Setpoint
When activated by a Digital Input selection, these annunciators will blink.

SP 1st Setpoint
SP2 2nd Setpoint
SP3 3rdSetpoint
RSP Remote Setpoint
CSP Computer Setpoint

Loop Display

L1 Loop 1 indication
When L1 is lit
the upper display shows the PV for Loop 1
the lower display shows the Loop 1 parameters and
the
PV for Loop 2
The controller setpoint annunciators show which setpoint is currently being used for Loop 1.

L2 Loop 2 indication
When L2 is lit
the upper display shows the PV for Loop 2
the lower display shows the Loop 2 parameters and
the
PV for Loop 1
The controller setpoint annunciators show which setpoint is currently being used for Loop 2.

For either Loop display, the “2” will blink when the Loop 1 output is being overridden by the Loop 2 output.

Cascade Control Annunciator

CAS The annunciator lights when the unit is in the Automatic Cascade Mode.

Annunciators for Temperature Units

° F Degrees Fahrenheit
° C Degrees Celsius

Continued on next page

Bargraphs

In addition to the displays and indicators described in Figure 5-1, the Operator Interface contains three bargraphs each containing 81 discrete bars, plus two arrows (top and bottom), used to display - left to right - (SP) Setpoint, (PV) Process Variable, and Output.

Each bar represents 1.25% full scale.

If the variable (SP, PV, Output):

- exceeds 100% of scale
  - All bars and the top arrow light
- exceeds 102% of scale
  - all bars light, top arrow blinks
- is 0% of scale
  - only the bottom bar lights
- goes below 0% of scale
  - bottom bar and bottom arrow light
- goes below –2% of scale
  - bottom bar lights, bottom arrow blinks

ATTENTION A 2 Loop display is also available. See subsection 5.13 for details.

The bargraph will flash when an alarm condition exists. See "Alarm Operation" in subsection 5.17.

Setpoint Bargraph

The Setpoint bargraph can be configured so that all the bars are lighted up to the setpoint value or just one bar is lighted at the setpoint value.
See *Section 3 - Configuration* under Setup prompt "DISPLAY".

Continued on next page

Viewing the operating parameters

Press the [LOWR DISP] key to scroll through the operating parameters listed in Table 5-4. The lower display will show only those parameters and their value that apply to your specific model and the way in which it was configured.

There is a 60 second time-out if the [LOWR DISP] key is not pressed.

The [LOWR DISP] key is also used to return to normal control mode from the Setup mode.

Table 5-4 Lower Display Key Parameter Prompts

LOWER DISPLAY INDICATION (XXXX = Value)	DEFINITION	REMARKS
OUTXXXX	OUTPUT (Note 1)	also estimated motor time for 3 Position Step control
OT2XXXX	OUTPUT #2 (note 1)	appears only if 2 loop or Cascade is configured
SPXXXX	LOCAL SETPOINT #1 (note 2)	also current setpoint when using SP Ramp
2SPXXXX	LOCAL SETPOINT #2 (note 2)	where RSP does not apply or for 2 loop applications
3SPXXXX	LOCAL SETPOINT #3	not available if RSP is configured
RSPXXXX	REMOTE SETPOINT (note 3)	not available if 3SP is configured
1INXXXX	INPUT 1	for more than one input enabled
2INXXXX	INPUT 2	for more than one input enabled
3INXXXX	INPUT 3	for more than one input enabled
4INXXXX	INPUT 4	for more than one input enabled
RA4XXXX	INPUT 4 RATIO VALUE	value can be selected using ▲ or ▼ keys
5INXXXX	INPUT 5	for multi-input activated
CSPXXXX	COMPUTER SETPOINT	when SP is in override
DEVXXXX	DEVIATION	maximum negative display is –999.9
PID SET X	TUNING PARAMETER SET 1 (note 4)	selected set for single or **primary** loop configuration where X = 1 or 2
2PID SET X	TUNING PARAMETER SET 2	selected set for single or **secondary** loop configuration where X = 3 or 4
RAMPXXXM	SINGLE SETPOINT RAMP TIME	time remaining in single setpoint ramp in minutes
1 PVXXXX	PROCESS VARIABLE 1	process variable 1 for 2 loop or cascade applications
2 PVXXXX	PROCESS VARIABLE 2	process variable 2 for 2 loop or cascade applications
NINEDIGIT	PROCESS ID TAG	a nine character, customer entered process ID tag
SPn	SP RATE SETPOINT	setpoint being used during setpoint rate
AUX	AUXILIARY OUTPUT (note 5)	Displayed whenever Loop 1 is not Current Duplex and Loop 2 is not configured or configured for TIME

Table 5-4 continued on next page

Viewing the operating parameters, continued

Table 5-4 Lower Display Key Parameter Prompts, continued

LOWER DISPLAY INDICATION (XXXX = Value)	DEFINITION	REMARKS
OC1	LOOP1 OUTPUT CHARACTERIZED	Displayed if Loop 1 output is characterized.
OC2	LOOP 2 OUTPUT CHARACTERIZED	Displayed if Loop 2 output is characterized.
Σ (Sigma)	CURRENT TOTALIZER VALUE	Displays the total flow volume being measured
BIAXXXX	MANUAL RESET VALUE	Displays the manual reset value for algorithm PD+MR.
TUNE OFF **TUNE RUN**	ACCUTUNE INDICATION(Note 1)	Appears when Accutune is enabled Press ▲ to initiate Accutune Display will read TUNE RUN
OT1	OUTPUT 1	Appears if using Output Override (2 PID loops only). This value is the calculated Loop 1 internal value before any override.

Note 1 The value can be changed only in Manual Mode.

Note 2 While viewing Setpoint 1 or Setpoint 2, the value can be changed by using the ▲ or ▼ keys. To switch between Setpoint 1 and Setpoint 2, press the SP1/SP2 key

Note 3 To switch between local and remote setpoint, press the RSP/CAS key

Note 4 When viewing the tuning parameters (PID SET1 or PID SET2), the selected set may be changed using the ▲ or ▼ keys.

Note 5 Auxiliary Output is not displayed, but the parameter that it represents is always available for display.

Diagnostic error messages

The UDC6300 performs background tests to verify data and memory integrity. If there is a malfunction, an error message will be displayed.

In the case of more than one simultaneous malfunctions, only the one with the highest priority will appear on the lower display.

A list of error messages is contained in Table 5-5.

If any of these error messages occur, refer to *Section 8 - Troubleshooting* for information to correct the failure.

Table 5-5 Error Messages

Prompt	Description
EE FAIL	Unable to write to non-volatile memory
IN1 FAIL	Two consecutive failures of input 1 integration
IN2 FAIL	Two consecutive failures of input 2 integration
IN3 FAIL	Two consecutive failures of input 3 integration
IN4 FAIL	Two consecutive failures of input 4 integration
IN5 FAIL	Two consecutive failures of input 5 integration
FAILSAFE	Input failure or internal diagnostics error
CONF ERR	• Low limit greater than high limit for PV, SP, Reset, or Output • Conflict between the remote mode switches and the input algorithm selection • Too many high level inputs are configured for the conversion rate being used
IN1 RANGE	Input 1 out-of-range
IN2 RANGE	Input 2 out-of-range
IN3 RANGE	Input 3 out-of-range
IN4 RANGE	Input 4 out-of-range
IN5 RANGE	Input 5 out-of-range Pulse input less than zero value or greater than span value
PV RANGE	PV ±10% out-of-range PV = INPX x INPX Ratio + INPX Bias If a Loop algorithm has been selected, this error message will appear when the result of the algorithm exceeds the PV limits.
RV RANGE	Remote Variable out-of-range Note: RV = InputX x RatioX x BiasX
DO FAILED	The read value of Digital Output 1 to 4 does not compare with the correct value.

5.5 Start Up Procedure

Procedure

The Start-up procedure is given in Table 5-6.

Table 5-6 Procedure for Starting Up the Controller

Step	Operation	Press	Action
1	Select manual mode	**MAN AUTO**	until “MAN” indicator is ON. The controller is in manual mode.
2	Adjust the output	▲ or ▼	to adjust the output value and ensure that the final control element is functioning correctly. Upper Display — shows the PV value Lower Display — shows OUT and the output value in %.
3	Tune the controller	**SET UP**	Make sure the controller has been configured properly and all the values and selections have been recorded on the Configuration Record Sheet. To tune your controller manually, see *Appendix A .* Refer to Set Up group ‘TUNING” to ensure that the proper selections for PROP BD or GAIN, RATE MIN, and RSET MIN or RSET RPM have been entered. For 2 Loop or Cascade control, refer to "TUNING L2" for tuning parameters. For controllers with ACCUTUNE, see the procedure in this section.
4	Enter the local setpoint	**LOWR DISP**	Upper Display — shows the PV Value Lower Display — SP and the local setpoint value
		▲ or ▼	To adjust the local setpoint to the value at which you want the process variable maintained. The local setpoint cannot be changed if the Setpoint Ramp function is enabled. “H” or “R” appears in the upper display.
5	Select Automatic Mode	**MAN AUTO**	until “A” indicator is ON. The controller is in Automatic mode. The controller will automatically adjust the output to maintain the process variable at setpoint, if the controller is properly tuned.

5.6 Operating Modes

Available modes

The controller can operate in any of five basic modes:

- Manual (One or Two Loops)
- Automatic with Local Setpoint (One or Two Loops)
- Automatic with Remote Setpoint (One or Two Loops)
- Manual (Cascade)
- Automatic (Cascade)

Manual and Automatic with Local set point are standard features and Automatic with Remote Setpoint is optional.

Mode definitions

Table 5-7 lists the five modes and their definitions.

Table 5-7 Operating Mode Definitions

Operating Mode	Definition
MANUAL	In Manual mode the operator directly controls the controller output level. When switched to manual mode, the controller holds its output at the last value used during automatic operation and stops adjusting the output for changes in setpoint or process variable. Instead, the configured High and Low Output Limits are disregarded and you adjust the output to the limits allowed by the output type by changing the value shown in the lower display. See "*Selecting Manual or Automatic"* in this subsection.
AUTOMATIC with LOCAL SETPOINT	In automatic local mode, the controller will operate from the local setpoint and automatically adjust the output to maintain the setpoint at the desired value. In this mode you can adjust the setpoint. See *Subsection 5.7* - "*Setpoints*".
AUTOMATIC with REMOTE SETPOINT	In automatic remote mode, the controller will operate from the setpoint measured at input 2, 3, 4, or 5. Adjustments are available to ratio this input and add a constant bias before it is applied to the control equation. See *Section 3 - Configuration, Set up group "Control".* *Not available in CASCADE.*
MANUAL (CASCADE)	In the manual cascade mode, both control loops are in manual although there is only one output active. This mode is used to bring both loops into a reasonable operation area, at which point the unit is placed into the Automatic Cascade Mode. If Loop 1 is placed in Manual control mode, then Loop 2, if in Auto, is then placed in a Pseudo-manual mode thereby eliminating output bumps when Loop 1 is returned to Automatic Control Mode.
AUTOMATIC (CASCADE)	In Automatic Cascade mode, there are two control loops, with one loop's output acting as the setpoint for the second control loop. There is only one physical output in this mode.

Continued on next page

What happens when you change modes

Table 5-8 explains what happens to the controller when you switch from one mode to another.

Table 5-8 Changing Operating Modes

Mode Change	Description
Manual to Automatic Local Setpoint	The local setpoint is usually the value previously stored as the local setpoint. PV Tracking is a configurable feature which modifies this. When it is selected, the local setpoint value tracks the process variable value continuously while in manual. LSP=PV at the moment you switch from manual to automatic. LSP holds at this one value.
Manual or Auto Local to Automatic Remote SP	The Remote setpoint value with Ratio and Bias applied is used to calculate the control setpoint. Auto Bias is a configurable feature which modifies this. When it is selected, the transfer from automatic local to automatic remote or from manual remote to auto remote adjusts the Bias based on the local setpoint such that Bias = LSP - [RSP Input x R].
Automatic Remote SP to Manual or Auto Local Setpoint	If configured for Local Setpoint Tracking, when the UDC transfers out of remote setpoint, the last value of the control setpoint is inserted into the local setpoint. If LSP tracking is not configured, the local setpoint will not be altered when the transfer is made.

Continued on next page

Selecting Manual or Automatic mode

An alternate action switch places the controller in Automatic or Manual mode of operation.

Switching between manual and automatic will be bumpless, except when PD+MR algorithm is selected.

Table 5-9 includes procedures for selecting automatic or manual mode and changing the output while in manual.

Table 5-9 Procedure for Selecting Automatic or Manual Mode

Step	Operation	Press	Action
1	Selecting Automatic Mode	MAN AUTO	until "AUTO" indicator is ON. The controller regulates its output to maintain the PV at the desired setpoint. Upper Display — shows the PV value Lower Display — shows SP and the setpoint value The deviation bargraph indicates the PV deviation from the setpoint. The annunciators will indicate whichever setpoint is in use: SP Local Setpoint SP2 Second Local Setpoint SP3 Third Local Setpoint RSP Remote Setpoint CSP Computer Setpoint
2	Selecting Manual Mode	MAN AUTO	until "MAN" indicator is ON. The controller holds its output at the last value used during automatic operation and stops adjusting the output for changes in setpoint or process variable. Upper Display — shows the PV value Lower Display — shows OUT and the output value in (%). The deviation bargraph indicates the PV deviation from the setpoint.

Table 5-9 continued on next page

Selecting Manual or Automatic mode, continued

Table 5-9 Procedure for Selecting Automatic or Manual Mode, continued

Step	Operation	Press	Action
3	Adjust the Output in Manual Mode	▲ or ▼	to adjust the output value while in manual mode. Upper Display shows the PV value Lower Display shows OUT and the output value in %.
4	Return to Automatic Mode	**MAN AUTO**	The “A” indicator will appear indicating Automatic mode.

5.7 Setpoints

Introduction

You can configure the following setpoints for the UDC6300 controller.

- A single local setpoint
- 2 local setpoints toggled by the SP1/SP2 key.
- A third local setpoint toggled by the RSP/CAS key.

Selecting the local setpoint source

Use the procedure in table 5-10 to select a local setpoint source.

Table 5-10 Procedure for Selecting the Local Setpoint Source

Step	Operation	Press	Action
1	Enter Set Up mode	SET UP	until the displays read: Upper Display: SET UP Lower Display: CONTROL or Upper Display: SET UP Lower Display: CONTROL2 for Loop 2
2	Display Local Setpoint Source selections	FUNC L1/L2	until the displays read: Upper Display: Setpoint source selections 1 ONLY TWO THREE Lower Display: LSP's
3	Select the desired source	▲ or ▼	to select the desired setpoint source in the upper display.
4	Return to control	LOWR DISP	The controller will assume normal control.

Continued on next page

Changing local setpoint 1 or 2 or 3

Use the procedure in Table 5-11 to change any of the local setpoint values.

After changing a Local Setpoint value, if no other key is pressed, it takes a minimum of 30 seconds elapsed time before the new value is stored in non-volatile memory.
If power is removed before this time, the new setpoint value is lost and the previous setpoint value is used at power up.
If after changing the LSP value, another key is pressed, then the value is stored immediately.

Table 5-11 Procedure for Changing the Local Setpoints

Step	Operation	Press	Action
1	Select the setpoint	**LOWR DISP**	until you see Upper Display — The PV value Lower Display — SP, SP2, or SP3 and the local setpoint value
2	Change the value	▲ or ▼	to change the local setpoint to the value at which you want the process maintained. SP, SP2, or SP3 indicator will light to match the lower display.

Continued on next page

Switching between local setpoint 1 and 2

Use the procedure in Table 5-12 to switch between Local Setpoint 1 and 2.

Table 5-12 Procedure for Switching Between Local Setpoint 1 and 2

Step	Operation	Press	Action
1	Select the setpoint	**SP1 / SP2**	to alternately switch between local setpoint 1 and local setpoint 2 (when configured). You will see: Upper Display — The PV value Lower Display — SP and the local setpoint #1 value, or 2 SP and the local setpoint #2 value
2	Change the value	▲ or ▼	to change the local setpoint to the value at which you want the process maintained. The display "blinks" if you attempt to enter setpoint values beyond the high and low setpoint limits. SP, SP2, or SP3 indicator will light to match the lower display. **ATTENTION** "KEY ERROR" will appear in the lower display if the 2nd local setpoint is not configured as a setpoint source or if you attempt to change the setpoint while a setpoint ramp is enabled. Setpoint ramp rate will apply to changes between local SP and local SP2, if enabled.

Continued on next page

Switching between local setpoint 3 and local setpoints 1 or 2.

Use the procedure in Table 5-13 to switch between Local Setpoint 3 and Local Setpoint 1 or 2.

Table 5-13 Procedure for Switching Between Local Setpoint 3 and Local Setpoint 1 or 2

Step	Operation	Press	Action
1	Select the setpoint	**RSP / CAS**	to alternately switch between local setpoint 3 and local setpoint 1 or local setpoint 2 (when configured).
2	Change the value	▲ or ▼	to change the local setpoint to the value at which you want the process maintained. The display "blinks" if you attempt to enter setpoint values beyond the high and low setpoint limits. SP, SP2, or SP3 indicator will light to match the lower display. **ATTENTION** "KEY ERROR" will appear in the lower display if 3 local setpoints are not configured or remote setpoint is not configured. Setpoint Ramp Rate will apply, if enabled.

Continued on next page

Selecting the remote setpoint source

You can select what you want your remote setpoint to be for each loop:

- None
- Remote setpoint using input 2 toggled by the RSP/CAS key
- Remote setpoint using input 3 toggled by the RSP/CAS key
- Remote setpoint using input 4 toggled by the RSP/CAS key
- Remote setpoint using input 5 toggled by the RSP/CAS key
- Remote setpoint using Loop 1 Input Algorithm
- Remote setpoint using Loop 2 Input Algorithm

Use the procedure in Table 5-14 to select the remote setpoint source.

Table 5-14 Procedure for Selecting the Remote Setpoint Source

Step	Operation	Press	Action
1	Select Set Up Group	SET UP	Until you see: Upper Display SET UP Lower Display CONTROL or Upper Display SET UP Lower Display CONTROL2 for Loop 2
2	Select the Remote Setpoint Source Prompt	FUNC L1/L2	Until you see: Upper Display [ ] ← The Remote Setpoint source selection Lower Display RSP SRC NONE - not used Input 2 - Input 2 as RSP Input 3 - Input 3 as RSP Input 4 - Input 4 as RSP Input 5 - Input 5 as RSP IN ALG1- Input algorithm 1 IN ALG2 - Input algorithm 2
3	Change selection	▲ or ▼	to change the remote setpoint source. **ATTENTION** You cannot change the Remote Setpoint Value using these keys.
4	Return to normal operation	LOWR DISP	This will return the controller to normal operation.

Continued on next page

Switching between local and remote setpoints

You can switch between Local and Remote setpoints. Use the procedure in Table 5-15 to switch between setpoints.

Table 5-15 Procedure for Switching Between Local and Remote Setpoints

Step	Operation	Press	Action
1	Select Local setpoint	**RSP CAS**	Until you see: Upper Display — The PV value Lower Display — SP, SP2, or SP3 and the local setpoint value
2	Change the Local setpoint value	▲ or ▼	The REMOTE setpoint cannot be changed at the keyboard.
3	Select Remote setpoint	**RSP CAS** again	You will see: Upper Display — The PV value Lower Display — RSP and the remote setpoint value

Continued on next page

Setpoint selection indication

Table 5-16 shows how the indicators react and what the displays show for each type of setpoint.

Table 5-16 Setpoint Selection Indication

	Using Local Setpoint	Using Remote Setpoint	Using 2nd Local Setpoint	Using 3rd Local Setpoint
Annunciator	**SP**	**RSP**	**SP2**	**SP3**
Upper Display	**PV** and the PV value	**PV** and the PV value	**PV** and the PV value	**PV** and the PV value
Lower Display	**SP** and the Local Setpoint Source	**RSP** and Remote Setpoint Value	**SP2** and the 2nd Local Setpoint Value	**SP3** and the 3rd Local Setpoint Value

5.8 Setpoint Rate

Configuration	You can configure a Setpoint Ramp Rate that will apply to any Local setpoint change immediately. Refer to the Configuration Section to enable the ramp for either loop and set an upscale or downscale rate value. Make sure SP RAMP is disabled.
Operation	When a Local setpoint change is made, the controller will ramp from the original setpoint to the new one at the rate specified. This changing (current) setpoint can be viewed as SPn on the lower display. Press the $\boxed{\text{LOWR DISP}}$ key until you see SPn and the setpoint value in the lower display.

5.9 Single Setpoint Ramp

Configuring the setpoint ramp

You can configure a single setpoint ramp to occur between the current local setpoint and a final local setpoint over a time interval of from 1 to 255 minutes. You can RUN or HOLD the ramp at any time.

Power Ouage

If power is lost during a SP Ramp, on power-up the controller 's PV will equal the setpoint and the ramp time will be recalculated. The mode and setpoint will be as configured in Set-up group 'CONTROL". Function prompt "PWR MODE".

Procedure

Table 5-17 lists the procedure for configuring the SP Ramp parameters.

Table 5-17 Procedure for Configuring a Setpoint Ramp

Step	Operation	Press	Action
1	Select SP RAMP Set Up Group	SET UP	Until you see: Upper Display: SET UP Lower Display: SP RAMP
2	Select the Setpoint Ramp function	FUNC L1/L2	Until you see: Upper Display: Enable –SP Ramp for Loop 1; Enable 2 –SP Ramp for Loop 2; Enable 12 –SP Ramp for Loops 1 and 2 Lower Display: SP RAMP
3	Enable Setpoint Ramp	▲	to enable the setpoint ramp function. Choose the Loop(s) on which you want the ramp to operate. NOTE: You cannot change the current local setpoint if the setpoint ramp function is enabled. Make sure SP RATE is disabled.
4	Set the Ramp Time	FUNC L1/L2	Until you see: Upper Display: The ramp time in minutes Lower Display: TIME MIN
		▲ or ▼	to change the upper display value to the number of minutes in which you want the final setpoint to be reached. Setting Range = 1 to 255 minutes NOTE: Entering "0" will imply an immediate step change to the final SP.
5	Set the Final Setpoint value	FUNC L1/L2	Upper Display: The Final Setpoint value Lower Display: FINAL SP
6		▲ or ▼	to change the upper display value to the desired final setpoint value. Setting Range = within the setpoint limits

Continued on next page

Running the setpoint ramp

Running a Setpoint Ramp includes starting, holding, viewing the ramp time, ending the ramp and disabling it.

Procedure

Table 5-18 lists the procedure for running the Setpoint Ramp.

Table 5-18 Procedure for Running a Setpoint Ramp

Step	Operation	Press	Action
1	Put the controller into Automatic mode	MAN AUTO	until "AUTO" indicator is ON and you will see: Upper Display — H and the PV value Lower Display — SP and the present setpoint value
2	Set Start SP	▲ or ▼	until the start setpoint value you desire is indicated in the lower display: Upper Display — H and the PV value Lower Display — SP and the start setpoint value
3	Start the Ramp	FUNC L1/L2 and ▲	simultaneously, you will see: Upper Display — R and the PV value Lower Display — SP and a changing setpoint value NOTE: The value in the lower display will be increasing or decreasing toward the final setpoint value. The PV value in the upper display will also change.
4	Hold/Run the Ramp	FUNC L1/L2 and ▲	simultaneously to hold the ramp at the current setpoint value. Press again to continue run. A "KEY ERROR" prompt will appear if FUNC and ▲ key is pressed while "SP RAMP" is disabled.
5	View the remaining ramp time	LOWR DISP	Until you see: Upper Display — R or H and the PV value Lower Display — RAMP XXXM (Time remaining)

Table 5-18 continued on next page

Procedure, continued

Table 5-18 Procedure for Running a Setpoint Ramp, continued

Step	Operation	Press	Action
6	Change setpoint during HOLD mode	▲ or ▼	to change the "HELD" setpoint if the ramp is on "HOLD". However, the ramp time remaining is not changed. Therefore, when returning to RUN mode, the setpoint will ramp at the same rate as previous to Local setpoint changes and will stop if the Final setpoint is reached before time expires. If the time expires before the final setpoint is reached, it will jump to the final setpoint.
6	End the Ramp		When the final setpoint is reached, the "R" changes to "H" in the upper display and the controller operates at the new setpoint. **ATTENTION** Anytime the local setpoint is different from the final setpoint value and the FUNC and ▲ key is pressed - the ramp will start again.
7	Disable the setpoint ramp function	**SET UP**	Until you see: Upper Display SET UP Lower Display SP RAMP
		FUNC L1/L2	You will see: Upper Display Enable **–SP Ramp for Loop 1** Enable 2 **–SP Ramp for Loop 2** Enable 12 **–SP Ramp for Loops 1 and 2** Lower Display SP RAMP
		▲	Until you see: Upper Display DISABL Lower Display SP RAMP
8	Return to normal operating mode	**LOWR DISP**	

5.10 Using Two Set of Tuning Constants

Introduction

You can use two set of tuning constants for single output types and 2 Loop or Cascade control and choose the way they are to be switched. (Does not apply for Duplex Control).

The sets can be:

- Keyboard selected
- Automatically switched when a predetermined Process Variable value is reached.
- Automatically switched when a predetermined Setpoint value is reached.

The following procedures show you how to:

- Select two sets or Gain Scheduling
- Set the switch-over value
- Set tuning constant value for each set
- Switch between two sets via the keyboard (without automatic switch-over)

Select two sets or gain scheduling

The procedure in Table 5-19 tells you how to select two sets or gain scheduling.

Table 5-19 Procedure for Selecting Two Set of Tuning Constants

Step	Operation	Press	Action
1	Select Control Set Up group	**SET UP**	Until you see: Upper Display SET UP, Lower Display CONTROL or For Loop 2 Upper Display SET UP, Lower Display CONTROL2
2	Select PID SETS function	**FUNC L1/L2**	Until you see: Upper Display [ ] ← Available selections are listed below; Lower Display PIDSETS **1 ONLY** - 1 set of constants **2 KEYBD** - 2 sets, keyboard selectable **2 PVSW** - 2 sets, auto switch at PV value **2 SPSW** - 2 sets, auto switch at SP value **GAIN SCDL** - Gain used in control algorithm calculations can be pre-entered into eight user-defined segments, with each segment applied over a user-defined PV range. Refer to *Section 3 - Configuration* under Set UP prompt "TUNING" to set Gain segment values and PV range values.
		▲ or ▼	to select the type of PID SET.

Continued on next page

Set switchover value

If you select 2 PVSW or 2 SPSW, you must set a value at which the sets will switch over.
The procedure in Table 5-20 shows you how to set this value.

Table 5-20 Procedure for Setting Switchover Values

Step	Operation	Press	Action
1	Select Switchover value function	**FUNC L1/L2** assuming you are still in Set Up group "CONTROL"	Until you see: Upper Display [ ] ← The switchover value; Lower Display [SW VALUE]
		▲ or ▼	to select the switch-over value in the upper display.

Set Tuning constant values for each set

There are specific tuning constants that must be set for each set. The procedure in Table 5-21 shows you how to access these constants and change their values.

Table 5-21 Procedure for Setting Tuning Constant Values

Step	Operation	Press	Action
1	Select Tuning Set Up Group	**SET UP**	Until you see: Upper Display [SET UP]; Lower Display [TUNING]
2	Select the tuning constants	**FUNC L1/L2**	to successively display the following constants: Upper Display [ ] ← The tuning constant value; Lower Display [ ] ← **PROP BD or GAIN*** **RATE*** **RSET*** **CYCLE** **PROP BD2 or GAIN2**** **RATE 2**** **RSET2**** **CYCLE2**
		▲ or ▼	To change the value of any of the above listed prompts in the lower display.

*PIDSET1 – will be used when PV or SP, whichever is selected, is greater than the switchover value.
**PIDSET2 – will be used when PV or SP, whichever is selected, is less than the switchover value.

Continued on next page

Switch between two sets via the keyboard (without automatic switch-over)

This procedure is operational only if 2 PID SETS was configured at "CONTROL" set up group.

The procedure in Table 5-22 shows you how to switch from one set to another.

Table 5-22 Procedure for switching PID SETS from the Keyboard

Step	Operation	Press	Action
1	Access the PID set display	LOWR DISP	Until you see: Upper Display: The PV value Lower Display: PIDSETX **X= 1 or 2**
		▲ or ▼	to change PID SET 1 to PID SET 2 or vice versa. You can use Adaptive Tune on each set.

5.11 2 Loops of Control Overview

Introduction

The UDC6300 can operate using Two Independent Loops of control or Internal Cascade control.

TWO INDEPENDENT LOOPS - See Functional Overview Block Diagrams for Loop 1(Figure 5-1) and Loop 2 (Figure 5-2) and Table 5-23 for selections based on these diagrams.

The following rules apply for Two independent loops:

• Current Output on Loop 2 requires 2nd Current output

• Loop 2 Current Duplex output is limited to 2nd Current output signal only

• Loop 2 Digital output is always dedicated to Digital Output 4

• No Time Duplex Outputs on Loop 2

• No ON/OFF or 3 Position Step algorithms in Loop 2

INTERNAL CASCADE CONTROL - uses Loop 2 as the primary loop with the output of loop 2 being the remote setpoint of Loop 1.

See Functional Overview Block Diagrams (Figure 5-3) and Table 5-23 for selections based on these diagrams.

The following rules apply for Internal Cascade control:

• Loop 2 must be the primary loop

• Loop 1 must be the secondary (internal or slave) loop because all output forms exist on Loop 1

• Loop 1 remote setpoint is fixed as Loop 2 output.

Selections

Refer to Figures 5-1, 5-2, and 5-3 Block Diagrams and Table 5-23 for selections based on these diagrams.

Table 5-23 Control Loop Selections

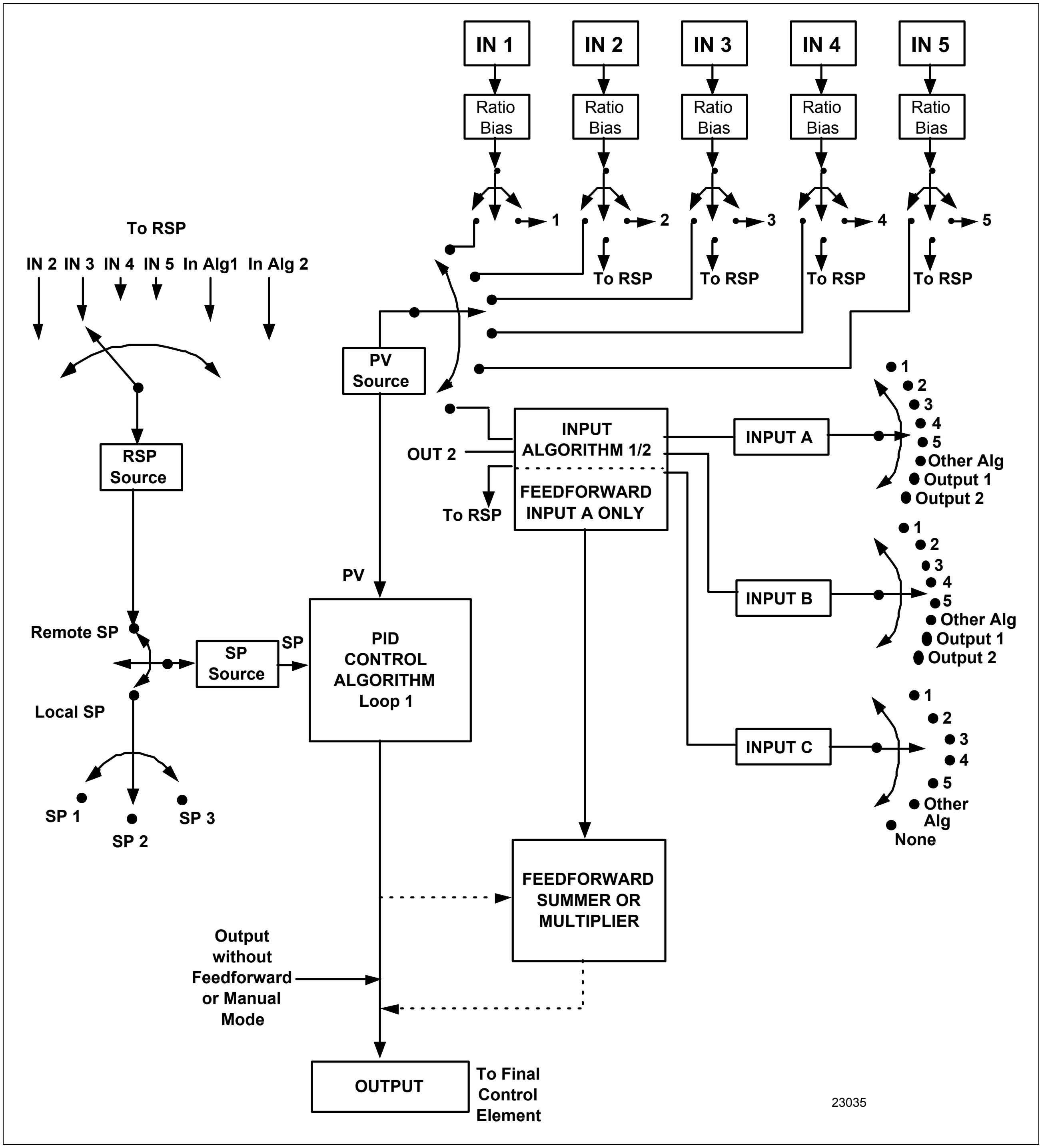
LOOP		INPUT 1	INPUT 2, 3, 4, Low Level 5, Pulse 5	INPUT ALG1	INPUT ALG2
LOOP 1	Process Variable	Via configuration or Digital Input 3, 4, 5, or 6	Via Configuration or Digital Input 1, 2, 3, 4, 5,6	Yes	Yes
	Remote Setpoint	Via configuration or Digital Input 3, 4, 5, or 6	Via configuration or Digital Input 3, 4, 5, or 6	Yes	Yes
	Feedforward	Yes	Yes	Yes	Yes
LOOP 2	Process Variable	Via configuration or Digital Input 4, 5, or 6	Via Configuration or Digital Input 2, 4, 5, or 6	Yes	Yes
	Remote Setpoint	Via configuration or Digital Input 4, 5, or 6	Via Configuration or Digital Input 2, 4, 5, or 6	Yes	Yes
	Feedforward	Yes	Yes	Yes	Yes

Continued on next page

Single Loop Controller

Figure 5-2 is a Block Diagram of a Single Loop Controller - Loop #1.

Figure 5-2 Functional Overview Block Diagram of a Single Loop Controller - Loop #1

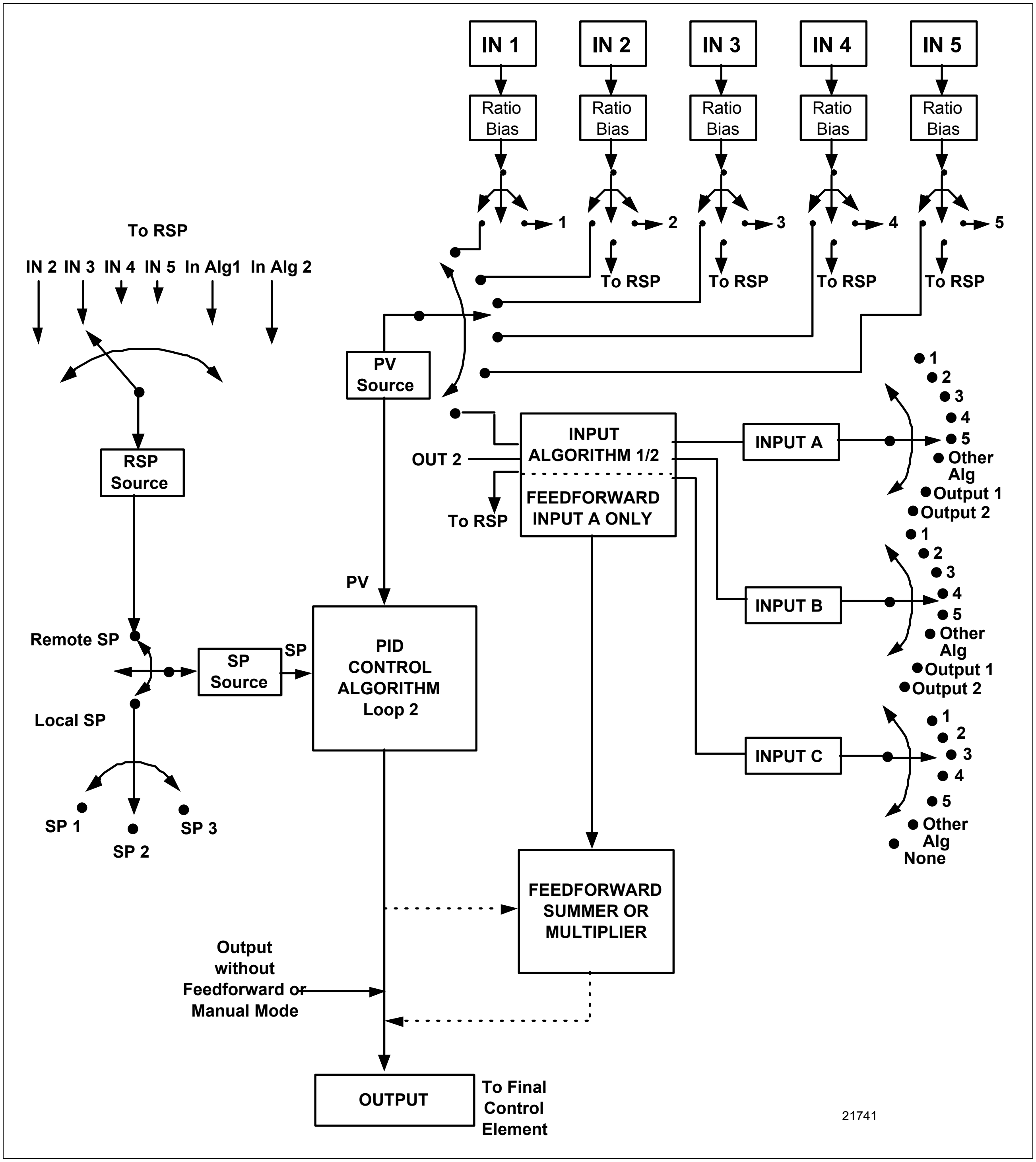


Continued on next page

Loop 2

Figure 5-3 is a Block Diagram of a Loop 2 of a 2 Loop controller.

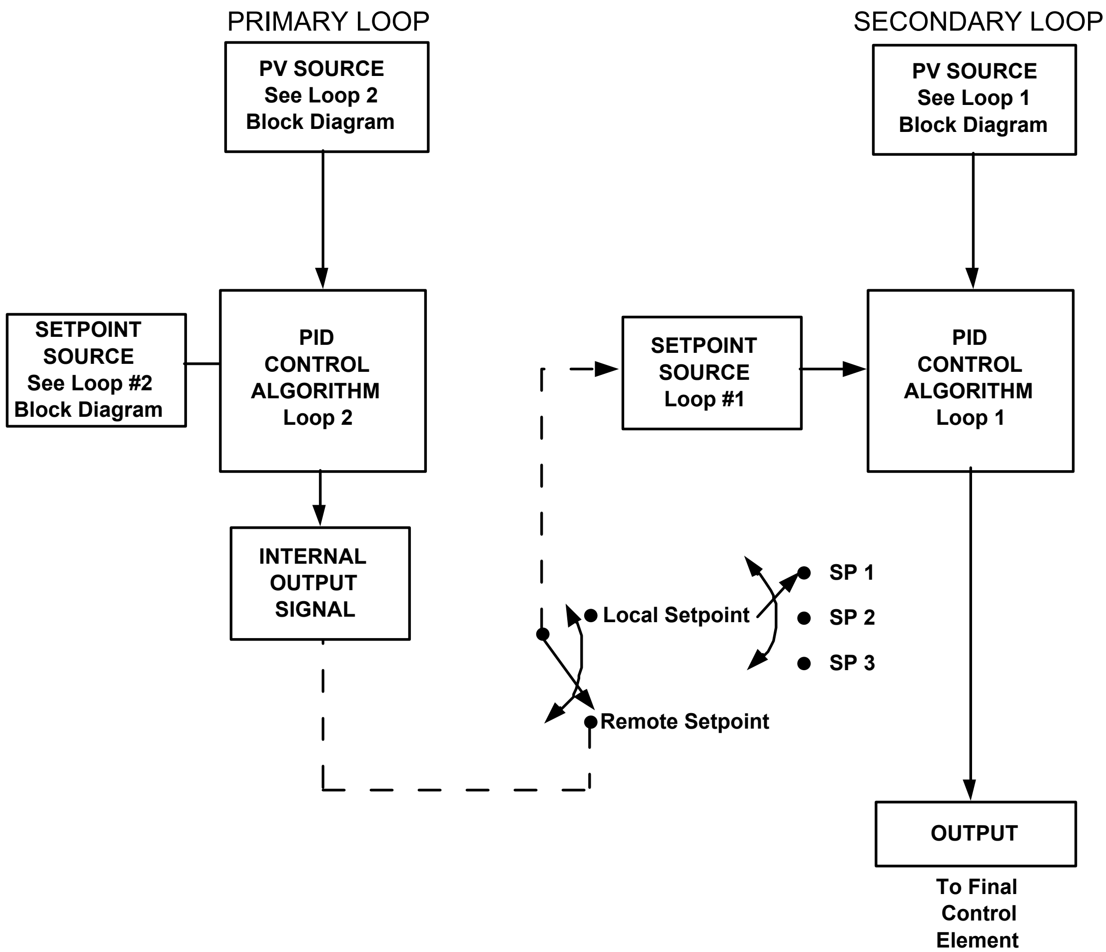
Figure 5-3 Functional Overview Block Diagram of Loop 2 of a 2 Loop Controller



Continued on next page

Internal Cascade Figure 5-4 is a Block Diagram of Internal Cascade for a 2 Loop controller.

Figure 5-4 Functional Overview Block Diagram of Internal Cascade of a 2 Loop Controller



INTERNAL CASCADE RULES

- Loop #2 must be the primary loop.
- Loop #1 must be the secondary (internal or slave) loop because all output forms exist on Loop 1.
- Loop #1 Remote Setpoint is fixed as loop #2 output.

Continued on next page

Override rules

The UDC 6300 allows you to select high or low output override. Refer to *Section 3 - Configuration* to select High or Low.

The following rules apply for high/low override:

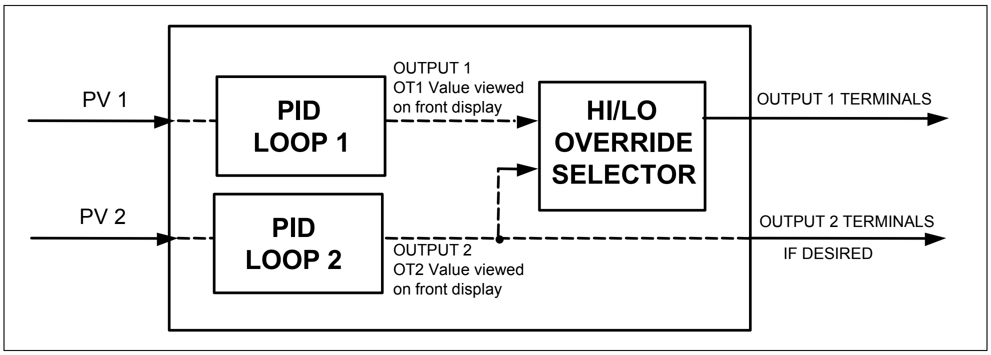
• Only one physical output is required when override is enabled. It is the output from Loop 1 because Loop 2's internal output is routed through the selector.

• Loop 2 output can also be available at all times if desired.

• In Manual mode, the Output may be overridden.

Figure 5-5 is a block diagram of the HI/LO Override Selector.

Figure 5-5 Hi/Lo Override Selector



5.12 Configure 2 Loop of Control

Select 2 loop algorithm

The procedure in Table 5-24 shows you how select the 2 loop algorithm.

Table 5-24 Procedure for Selecting 2 Loop Algorithm

Step	Operation	Press	Action
1	Select Algorithm Set Up Group	**SET UP**	Until you see: Upper Display SET UP Lower Display ALGORTHM
2	Select the PID Loops	**FUNC L1/L2**	to successively display the following constants: Upper Display **1 LOOP** **2LOOPS** **CASCADE** Lower Display ALGORTHM
		▲ or ▼	To select 2 Loops or Cascade.

Select the output algorithm for each loop

See *Subsection 5.11* for rules and regulations then follow the procedure in Table 5-25.

Table 5-25 Procedure for Selecting Output Algorithm

Step	Operation	Press	Action
1	Select Output Algorithm Set Up Group	**SET UP**	Until you see: Upper Display SET UP Lower Display OUT ALG
2	Select Loop 1 Algorithms	**FUNC L1/L2**	to successively display the following constants: Upper Display **TIME** **CURRENT** **TIME DPLX** **CUR DPLX** **CUR TIME** **TIME CUR** Lower Display OUT ALG
		▲ or ▼	To select Loop 1 algorithm.

Table 5-5 continued on next page

Select the output algorithm for each loop, continued

Table 5-25 Procedure for Selecting Output Algorithm, continued

Step	Operation	Press	Action
3	Select Loop 2 algorithms	FUNC L1/L2	Until you see: Upper Display: NONE / TIME / CURRENT / CUR DPLX / CUR TIME / TIME CUR Lower Display: OUT 2 ALG
		▲ or ▼	To select Loop 2 algorithm.

Select control parameters for each loop

The procedure in Table 5-26 shows you how select the 2 loop algorithm.

Table 5-26 Procedure for Selecting Control Parameters

Step	Operation	Press	Action
1	Select Control Set Up Group	SET UP	Until you see: Upper Display: SET UP Lower Display: CONTROL or Upper Display: SET UP Lower Display: CONTROL2 For Loop 2
2			Refer to *Subsection 5.11* for rules and restrictions and to *Section 3 - Configuration* to select the individual parameters.

Continued on next page

Select tuning parameters for each group

The procedure in Table 5-27 shows you how select the Tuning Parameters.

Table 5-27 Procedure for Selecting Tuning Parameters

Step	Operation	Press	Action
1	Select Tuning Set Up Group	**SET UP**	Until you see: Upper Display: SET UP — Lower Display: TUNING or Upper Display: SET UP — Lower Display: TUNING 2 For Loop 2 PID set 1 and 2 (TUNING) are for Loop 1 and single loop applications. PID set 3 and 4 (TUNING2) are for Loop 2 in two loop and cascade control applications.
2	Select Tuning constants	**FUNC L1/L2**	to successively display the following constants: Upper Display ← The Tuning Constant Value Lower Display ← **TUNING CONSTANTS for Primary Loop** **PROP BAND or GAIN** **RATE (MIN)** **RESET (MIN OR RPM)** **CYCLE** **PROP BAND2 or GAIN2** **RATE2 (MIN)** **RESET2 (MIN OR RPM)** **CYCLE2** **OR** **TUNING CONSTANTS for LOOP 2** **PROP BAND3 or GAIN3** **RATE3 (MIN)** **RESET3 (MIN OR RPM)** **CYCLE3** **PROP BAND4 or GAIN4** **RATE4 (MIN)** **RESET4 (MIN OR RPM)** **CYCLE4** Refer to *Section 3 - Configuration* for detailed information. You can Adaptive Tune both sets on either loop. Refer to *Subsection 5.19.* Use the FUNC key to switch between loops.
		▲ or ▼	To change the values.

5.13 Monitor 2 Loops of Control

Introduction

Monitoring two individual loops of control or Internal Cascade is the same as a single loop except that Indicator L1 and L2 become Loop 1 and Loop 2 indicators when more than one control loop is enabled.

Digital display indication

Table 5-28 shows you the meaning of the digital displays when monitoring 2 loops of control.

Table 5-28 Digital Display Indication - 2 Loops

Indicator	Loop Indication	Definition
L1	Loop 1	When L1 is lit: the upper display shows the Process Variable (PV) for Loop 1; the lower display shows the Loop 1 parameters and the PV and Output for Loop 2. The controller Setpoint annunciators show the setpoint currently being used for Loop 1.
L2	Loop 2	When L2 is lit: the upper display shows the Process Variable (PV) for Loop 2; the lower display shows the Loop 2 parameters and the PV and Output for Loop 1. The controller Setpoint annunciators show the setpoint currently being used for Loop 2.

Continued on next page

Bargraph indication for 2 loops

What the Bargraphs represent depends on what selection you make at Set Up prompt "DISPLAY", function prompt "2 LOOP DIS". Refer to *Section 3 - Configuration* for selection information.

Table 5-29 shows you the meaning of the bargraphs when monitoring 2 loops of control.

Table 5-29 Bargraph Indication - 2 Loops

2 LOOP DIS Selection	Bargraph	Indication
SPnPVnOn	Left	Indicates SP of Loop selected.
	Center	Indicates PV of same Loop.
	Right	Indicates output of same loop. (Loop selected is indicated by L1 or L2.)
L1 L2 On	Left	Indicates Loop 1 PV as a column of bars — SP is a single blinking bar.
	Center	Indicates Loop 2 PV as a column of bars — SP is a single blinking bar.
	Right	Indicates Output of Loop selected as shown by L1 or L2 digital display.
L1 — On	Left	Indicates Loop 1 PV as a column of bars — SP is a single blinking bar.
	Center	Blank
	Right	Indicates Output of Loop selected as shown by L1 or L2 digital display.
— L2 On	Left	Blank
	Center	Indicates Loop 2 PV as a column of bars — SP is a single blinking bar.
	Right	Indicates Output of Loop selected as shown by L1 or L2 digital display.

Loop display

Display of Loop 1 or Loop 2 (if configured) is selected by toggling the [FUNC] key.

Viewing each loop's process variable

Regardless of which loop is being displayed "1" or "2", the process variable of the non-displayed loop can be shown in the lower display by repeated presses of the [LOWR DISP] key until "**1PVXXXX**" or "**2PVXXXX**" is displayed.

Continued on next page

Internal cascade indication

When Internal Cascade has been configured, an "CAS" annunciator lights as long as Loop 1 is operating in the remote setpoint mode (for example: RSP is displayed).

If Local setpoint 1 and 2 is being used, the "CAS" will disappear until the remote setpoint [RSP CAS] key is pushed to switch from local setpoint to remote setpoint.

Switching between automatic and manual modes on either loop will not affect the Internal Cascade indication.

5.14 Operate 2 Loops of Control

Loop operation	Operation of two individual loops of control is identical to operating a single loop of control except that TUNING 2 group applies to Loop 2 only and two PID sets, 3 and 4, are available. TUNING group applies to Loop 1 with PID sets 1 and 2 applicable.
Operating modes and setpoint source	The rules for Auto/Manual modes and changing setpoint sources are the same as single loop operation.
Keyboard operation	Note that the loop being displayed is the only loop affected by normal keyboard operation. However, either loop can be re-configured when in the Set Up mode regardless of which is being displayed during normal operation.
Accutune TM - Adaptive tune	Two independent loops or cascaded loops can be Adaptive tuned at the same time, if configured.
Setpoint Ramp	Either loop or both loops can be configured for a single setpoint ramp operation by enabling the desired loop or loops (see *Section 3 - Configuration*). An “H” or “R” will appear when applicable, depending upon which loop is being displayed. The RUN/HOLD operation is shown in Table 5-18 “Running a Single Setpoint Ramp”.
Digital inputs	Digital Input 2 is dedicated to Loop 2 and Digital Input 1 and Digital Input 3 are dedicated to Loop 1 when two loops or Cascade control is configured. Digital Inputs 4, 5, and 6 can be assigned to either loop.
Output override Hi/Lo select	Output Override allows you to select the higher of Output 1 and Output 2 (Hi Select) or the lower of Output 1 and Output 2 (Lo Select) to appear at Output 1 terminals to drive the final control element. Refer to *Subsection 5.11* for Override rules and block diagram. Override prompts appear under Set Up group “ALGORTHM” and function prompt “OUT OVRD”.

5.15 Input Math Algorithms

Introduction

This controller is provided with two input algorithms. Each algorithm can be configured to provide a derived (calculated) PV or a derived Remote setpoint. Up to three inputs may be applied to the calculation. In addition, the 2 algorithms may be “linked” to combine two calculations by configuring one algorithm to be an input to the other algorithm.

Input algorithm selections

Algorithm selections are made in *Section 3 - Configuration*; Set Up group “ALGORITHM”, under the following function prompts:

IN ALG1
IN ALG2

These selections include the following algorithms:

Weighted Average
Feedforward Summer
Summer
Hi Select
Lo Select
|Mul Div
|Multiply
Mult Div
Multiply
Feedforward Multiplier

The formulas for these selections are given in Table 4-5 in *Section 4 - Definitions* .

Input A, B, and C selections for these formulas are found in *Section 3 - Configuration*; Set Up group “ALGORITHM”, under the following function prompts:

ALG 1IN A
ALG 1IN B
ALG 1IN C
ALG 2IN A
ALG 2IN B
ALG 2IN C

Continued on next page

8 segment characterization

Two 8-Segment Characterization selections can made in *Section 3 - Configuration*; Set Up group "ALGORITHM", under function prompts:

8 SEG CHAR
Xn VALUE
Yn VALUE
8 SEG CHA2
Xn VALUE2
Yn VALUE2

An 8 segment characterizer can be applied to either Input 2 or Input 4, Output 1, or Output 2.

When Input 2 or Input 4 is used, the selected inputs Ratio and Bias are applied to the Xn values.

When one of the loop outputs is selected, the Xn Values are the output from the control algorithm, and the Yn Output is the final control element action.

An example of 8 Segment Characterization is shown in Figure 4-2.

Polynomial Equation

A fifth order Polynomial equation can be used on any one of the five Analog Inputs. The equation is in the form:

$$Y = C_5 * 10^{-7} X^5 + C_4 * 10^{-5} X^4 + C_3 * 10^{-3} X^3 + C_2 * 10^{-1} X^2 + C_1 X + C_0$$

Where:

X is the analog input selected
C_0 is a value between –99.99 to +99.99
C_1 - C_5 are values between –9.999 to +9.999

Ratio and Bias can be applied on the "Y" output term as follows:
Calculated "Y" Value =
Y * Input x Ratio + InputX Bias
Where: "X" refers to the analog input being used and the range assigned to the "X" input chosen applies to the "Y" calculated value.

Refer to *Section 3 - Configuration*, Set Up group "ALGORTHM", function prompt "POLYNOM" to select an input, and "C0 VALUE" through "C5 VALUE" to enter the coefficients.

Continued on next page

Totalizer function

A **Flow Totalizer** is available as part of the Math Algorithm option. This calculates and displays the total flow volume being measured by input 1. Alternatively, it can be applied to either Input Algorithm 1 or Input Algorithm 2 to totalize the compensated flow rate being calculated by the algorithm.

The **totalizer displays** the current totalized flow value (up to eight digits maximum). Seven **scaling factors** are available (from 1 to 1 million). The desired scaling factor is applied to the calculated value to extend the maximum total flow range that can be displayed.

Five integration rates are available to match the totalizer rate to the rate of flow being measured. The rate are:

Engineering Units (EU) per second
EU per minute
EU per hour
EU per day
Millions of units per day

The Totalizer value is stored in non-volatile memory once every eight hours. If **power is lost** while the totalizer is in operation, the current value of the totalizer will be lost. When **power is restored**, the Totalizer will start operation for the last value stored in non-volatile memory. The "Σ **(Sigma)**" display will blink to indicate this condition. Reset the Totalizer.

The Totalizer can be **reset** from the keyboard whenever desired or by configuring a Comparator Logic Gate.

The Totalizer should always be reset to initialize the counters whenever it is enabled, otherwise, the "Σ (Sigma)" display will blink

Refer to *Section 3 - Configuration*, Set Up group ALGORTHM", function prompt "TOTALIZER" to select an application and the function prompts that follow "TOTALIZER" to enter your scale factor and rate of integration.

5.16 Logic Gate Operation

Introduction

The UDC6300 Logic Gate function lets you configure up to 5 Dual-Input Logic Gates. Each gate can be one of the eight gate types listed below including two comparators:

OR
NOR
AND
NAND
XOR
XNOR

These gates have two **Digital** input sources and one Digital output use.

B<A
B>A

These comparator gates have two **Analog** input sources and one Digital output use with input B having a fixed hysteresis band of 0.1% of input B span.

Gate configuration

Refer to *Section 3 - Configuration* under Set Up group “ADVANCED MATH” to make your choices for the following function prompts:

GATE TYPE
INPUT A SOURCE
INPUT B SOURCE
OUTPUT USE

for each gate you want to configure.

Gate Operation

Section 4 - Definitions contains information which defines how the different gates operate. In Digital Logic there are only two states that can be present “0” -OFF or “1” -ON. Section 4 lists the types of gates available along with their truth tables. These tables indicate what happens to the output of each gate with regard to the state of the inputs. The rules and regulations are listed in Table 5-30.

Continued on next page

Rules and regulations

The output of the Logic Gates are subject to the configuration constraints and dynamic operational status of the UDC 6300 as listed in Table 5-30.

Table 5-30 Logic Gates Constraints and Dynamic Operation Status

UDC6300	Rules and Regulations
Alarms	Alarms take precedent over gate outputs. No gate output will occur if the output is directed to Digital Output 1 or Digital Output 2 and the corresponding Alarm 1, Alarm 2, Digital Input 3 - Alarm 3, Digital Input 4 - Alarm 4 is also configured.
Output Algorithms	Certain output algorithms take precedence over gate outputs. No gate output will occur if the output is directed to Digital Output 3 or Digital Output 4 and a conflicting output algorithm is also configured (for example: Time Simplex, Time Duplex, etc.).
External Switch	Some External Switch configurations take precedence over gate outputs. No gate output will occur when the following conditions exist: • Gate output directed to Digital Output 3 or 4 and an <u>active</u> external switch is configured for “OUT 3 ON” or “OUT 4 ON” respectively. • Gate Output directed to Manual/Auto mode and an <u>active</u> external switch is configured for “TO MAN” or “TO MANFSAFE”. • Gate Output directed to Local/Remote Setpoint and an <u>active</u> external switch is configured for “ToRSP”. Gate Output will resume when the switch becomes **inactive**.
Communications	Communications takes priority over gate output as follows: • No Gate Output will occur if directed to Manual/Auto and the Host computer places the unit (loop) into Manual or Automatic mode. • No Gate Output will occur if directed to Local/Remote and the Host computer selects either Local or Remote setpoint. Gate output will resume when the Host computer puts the unit (loop) into the monitor state or the unit sheds from the Host.
Mode or Setpoint	If a Logic Gate output is configured for Manual/Auto or Local/Remote Setpoint, use of the [MAN AUTO] key or [RSP/CAS] keys respectively will result in a key error. However, the [MAN AUTO] key is permitted during communications when the Host computer has mode control.

5.17 Digital Outputs

Alarms

Digital Outputs 1,2,3, and 4 can be configured through the keyboard to be alarm signals. Refer to *Section 3 - Configuration*, Set Up group "ALARMS" to set the following:

- Events on which you want to alarm
- Alarm Values
- High or Low states
- Hysteresis
- Action - energize or de-energize
- Latching or Non-Latching Alarm Outputs

Latching alarms

Bargraphs flash until the ALM/ACK key is pressed.

– If the **alarm condition has ended**, the Alarm Digital Output and indicator will turn **OFF**
– If the **alarm condition still exists**, the Alarm Digital Output and indicator will stay **ON**.

Non-Latching alarms

Bargraphs flash until the ALM/ACK key is pressed or alarm condition ends.
– Alarm Digital Output and indicators will remain on until alarm condition ends.

Alarm operation

Table 5-31 shows the operation of the Digital Output, annunciator, and bargraphs for both configurations.

Press the ALM/ACK key to view the Alarm Group Parameters.

Table 5-31 Latching and Non-Latching Alarm Operation

Alarm Configuration	Alarm Condition	Alarm ACK Key Pressed	Digital Outputs		Annunciators ***	Bargraphs
			EN*	DEN**		
Non Latching	STILL EXISTS	NO	ON	OFF	FLASHING	FLASHING
		YES	ON	OFF	ON	NORMAL
	ENDED	NO	OFF	ON	OFF	NORMAL
		YES	OFF	ON	OFF	NORMAL
Latching****	STILL EXISTS	NO	ON	OFF	FLASHING	FLASHING
		YES	ON	OFF	ON	NORMAL
	ENDED	NO	ON	OFF	FLASHING	FLASHING
		YES	OFF	ON	OFF	NORMAL

* "EN" is the "Digital Outputs Energized on Alarm" configuration
** "DEN" is the "Digital Outputs De-energized on Alarm" configuration
*** Only the Annunciator associated with the alarm will flash.
**** For CE conformity, Performance Criterion A, select "NON-LATCHING".

Continued on next page

Configuration Options - Digital Outputs 1 and 2

Digital Outputs 1 and 2 can also be configured to operate as an Output for a Logic gate:

- GATE 1 OUT, GATE 2 OUT, GATE 3 OUT, GATE 4 OUT, or GATE 5 OUT prompt, under Set Up Group "Advanced Math", configured for DIG OUT 1 or DIG OUT 2.

Configuration options - Digital Outputs 3 and 4

Digital Outputs 3 and 4 have several different configuration options from which to choose:

DIGITAL OUTPUT 3

- DIG IN 1 (Digital Input 1) or DIG IN2 (Digital Input 2) prompt, under Set Up Group "Options", configured for OUT 3 ON.
- A3S1 TYPE (Alarm 3, Setpoint 1) or A3S2 TYPE (Alarm 3, Setpoint 2) prompt, under Set UP Group "Alarms", configured for any selection except "NONE".
- OUT ALG (Output Algorithm) prompt, under Set Up Group "Output Algorithm", configured for TIME, TIME DPLX, CUR TIME, or TIME CUR.
- GATE 1 OUT, GATE 2 OUT, GATE 3 OUT, GATE 4 OUT, or GATE 5 OUT prompt, under Set Up Group "Advanced Math", configured for DIG OUT 3

DIGITAL OUTPUT 4

- DIG IN 1 (Digital Input 1) or DIG IN2 (Digital Input 2) prompt, under Set Up Group "Options", configured for OUT 4 ON.
- A4S1 TYPE (Alarm 4, Setpoint 1) or A4S2 TYPE (Alarm 4, Setpoint 2) prompt, under Set UP Group "Alarms", configured for any selection except "NONE".
- OUT ALG (Output Algorithm) prompt, under Set Up Group "Output Algorithm", configured for TIME DPLX.
- OUT2ALG (Output Algorithm 2) prompt, under Set Up Group "Output Algorithm", configured for TIME, CUR TIME, or TIME CUR.
- GATE 1 OUT, GATE 2 OUT, GATE 3 OUT, GATE 4 OUT, or GATE 5 OUT prompt, under Set Up Group "Advanced Math", configured for DIG OUT 4

Continued on next page

Priority level for digital outputs

The controller will control the Digital Outputs using the following structure:

Priority Level	*Function*
1(Highest)	Output Algorithm
2	Alarms
3(Lowest)	Digital Input and Gate Outputs

Output algorithm and alarms priority

The output algorithm has the highest priority, so, that when an output algorithm is programmed to use a digital output, the alarm type for that output will not be accessible form the keyboard.

For example:

If OUT ALG prompt in Set UP Group "Output Algorithm" is configured for TIME, then A3S1 TYPE and A3S2 TYPE prompts in Set UP Group "Alarms" will not be displayed in this Set Up group.

Digital Input and gate output priority

The Digital Inputs and the Gate Outputs have the same priority. They operate as an OR function with one another. The digital output will be active if either digital input or the gate output is a "TRUE" condition.

These conditions are ignored when an output is configured for either an output algorithm or an alarm.

5.18 Digital Input Option (Remote Switching)

Digital Input 1 and 2

The Digital Input option detects the state of external contacts for either of two inputs. On contact closure, the controller will respond according to how each digital input is configured.

If the controller is configured for either Two Loop or Cascade control, then switch #1 operates only on Loop 1 and switch #2 operates only on Loop 2.

Make your selection under Set Up group "OPTION", function group prompt "DIG IN1" or "DIG IN2". See *Section 3 - Configuration*.

Digital input 1 and 2 Action on closure

Table 5-32 lists the configuration prompt selections, the "Action on Closure", and the display indication for each selection available.

Table 5-32 Digital Input 1 and 2 Option Action on Contact Closure

DIG IN1 or DIG IN2 selections	Display Indication	Action on contact closure*
To MANUAL	"MAN" blinks	Puts the controller into manual mode.
To SP1	"SP" blinks	Selects the local setpoint.
To SP2	"SP2" blinks	Selects the second local setpoint.
To SP3	"SP3" blinks	Selects the third local setpoint.
To DIRECT	"1" or "2" blinks	Selects direct controller action.
ToHOLD	"H" blinks	Suspends setpoint ramp.
ToPID2	PID2 in lower display "1" or "2" blinks	Selects PID2.
PV IS IN2	II IN blinking	Selects the PV to equal Input 2.
PV IS IN3	III IN blinking	Selects the PV to equal Input 3.
PV IS IN4	IV IN blinking	Selects the PV to equal Input 4.
PV IS IN5	V IN blinking	Selects the PV to equal Input 5.
To RUN	"R" indicator blinks	Starts a stopped SP Ramp.
TRACK 1	"O" blinks when L1 is lighted	Allows Output 1 to track Input 4.
TRACK 2	"O" blinks when L2 is lighted	Allows Output 2 to track Input 4.
TO OUT 2	"2" blinks when L1 or L2 is lighted	Allows Output 2 to override Output 1.
MANFSAFE	"MAN" blinks	Unit goes to Manual Mode, output goes to the Failsafe value.

*Returns (toggles) to original state when contact opens.

**Open contact selects upward direction.

Table 5-32 continued on next page

Digital input 1 and 2 Action on closure, continued

Table 5-32 Digital Input 1 and 2 Option Action on Contact Closure, continued

DIG IN1 or DIG IN2 selections	Display Indication	Action on contact closure*
PULSEDOWN	"1" or "2" blinks	Select downward direction for pulse input setpoint adjustment.**
OUT 3 ON	Output 3 annunciator lights "1" or "2" blinks	Output 3 energized
OUT 4 ON	Output 4 annunciator lights "1" or "2" blinks	Output 4 energized
INHIBIT 1	"1" or "2" blinks	Inhibit PID Reset Action.
TO RSP	"RSP" blinks	Selects Remote Setpoint.
DSP LOOP L1/L2	L1 or L2 is lighted	Displays loop not being displayed.
RESET FB	"1" or "2" blinks	Allows input 3 to override the internal reset value providing external reset feedback.
TO A/M STA	"LSP2" blinks II IN blinking	When the switch is closed, the loop performs as follows: PV = In2 Action = Direct Control Algorithm = PD+MR PIDSET = 2 SP = LSP2
TO PURGE	"MAN" blinks	When the switch is closed, the loop is forced to Manual mode with the Output value set to the *High Output Limit*. The configuration of the Latching function determines whether the action is momentary or latching.
LOW FIRE	"MAN" blinks	When the switch is closed, the loop is forced to Manual mode with the Output value set to the *Low Output Limit*. The configuration of the Latching function determines whether the action is momentary or latching.
ToTUNE	*"TUNE" or "SP" Tuning* - a large "T" appears in the upper display *"PV" tuning* - displays a small "t" in the upper display	Starts the Accutune process.

*Returns (toggles) to original state when contact opens.

**Open contact selects upward direction.

Keyboard operation

Front panel keys have no effect on the DI action in the closed state.

Continued on next page

Digital input 1 and 2 combination selections

The Digital Input combination selections listed in Table 5-33 and 5-34 can be used in combination with the Digital Inputs 1 and 2 listed in Table 5-32.
Refer to Section 3 - Configuration and make your selections under Set Up prompt “OPTIONS”; Function prompt “DIG 1 COMB” or “DIG 2 COMB”

Table 5-33 Digital Input Combinations “DIG IN 1”

Selections used in Combination with “DIG IN1”	Display Indication	Action on contact closure*
+ To PID2	Lower Display = PID SET 2	Selects PID 2.
+To DIRECT	“1” or “2” blinks	Puts the controller into direct controller action.
+ To SP2	“SP2” blinks	Selects the Second Local Setpoint
+ DIS ADT1	“T” no longer lighted	Disable Adaptive tune - Loop 1.
+ To SP1	“SP” blinks	Selects the local setpoint.
To RUN	“R” indicator blinks	Starts or restarts RUN of SP Ramp.

*Returns (toggles) to original state when contact opens.

Table 5-34 Digital Input Combinations “DIG IN 2”

Selections used in Combination with “DIG IN2”	Display Indication	Action on contact closure*
+ To PID2	Lower Display = PID SET 2	Selects PID 2.
+To DIRECT	“1” or “2” blinks	Puts the controller into direct controller action.
+ To SP2	“SP2” blinks	Selects the second local setpoint.
+ DIS ADT2	“T” no longer lighted	Disable Adaptive tune - Loop 2.
+ To SP1	“SP” blinks	Selects the local setpoint.
To RUN	“R” indicator blinks	Starts or restarts RUN of SP Ramp.

*Returns (toggles) to original state when contact opens.

Continued on next page

Digital input 1 and 2 combination operation

There are five possible situations that can occur when working with Digital Input combinations. Table 5-35 lists these situations and the resulting action when the switch is active.

In the table:

Enabled means that the parameter is configured, and the action will occur when the Digital Input is active

Action Disabled means that DIG IN or DIG COMB is configured but the action cannot occur when the digital input is active because the selected parameter is disabled.

Table 5-35 Digital Input 1 and 2 Combination Operation

DIG IN	DIG COMB	ACTION	EXAMPLE
NONE	Any Selection	No action will occur when the Digital Input is active	
ENABLED	**DISABLED**	The DIG IN condition will occur when the Digital Input is active.	**DIG IN 1** = TO MANUAL **DIG COMB** = DISABLED Loop 1 will switch to MANUAL when Digital Input 1 is active
ACTION DISABLED	**ENABLED**	No action will occur when the Digital Input is active	**DIG IN 1** = TO PID 2 **PID SETS** = 1 ONLY **DIG 1 COMB** = +TO SP2 **LSP'S** = TWO DIG IN 1 is action disabled because PID SETS is set to 1ONLY. Therefore, when Digital Input 1 is active, no action will occur even though DIG1 COMB is enabled.
ENABLED	**ACTION DISABLED**	Action is indeterminate when the Digital Input is active	**DIG IN 1** = TO PID 2 **PID SETS** = 2KEYBD **DIG 1 COMB** = +TO SP2 **LSP'S** =1ONLY Because DIG 1 COMB is action disabled, the action will be indeterminate when DIG IN1 is active.
ENABLED	**ENABLED**	Both DIG IN and DIG COMB action will occur.	

Continued on next page

Digital input 3,4,5,and 6

The Digital Input option also detects the state of external contacts for either Digital Input 3, 4, 5, or 6. On contact closure, the controller will respond according to how each digital input is configured.

Make your selection under Set Up group "OPTION", function group prompt "DIG IN3", "DIG IN4","DIG IN5", or "DIG IN6".
See *Section 3 - Configuration*.

Notes

Digital Input 3 is internally connected (shares rear terminals) with the Alarm 1 Digital Output 1.

Digital Input 4 is internally connected (shares rear terminals) with the Alarm 2 Digital Output 2.

Digital Input 5 is internally connected (shares rear terminals) with the Alarm 3 Digital Output 3 which can be used by:
- Loop 1 Time Proportioning - Heat Output
- Alarm 3
- Logic Gates

Any use of these outputs will also trigger this Digital Input.

Digital Input 6 is internally connected (shares rear terminals) with the Alarm 4 Digital Output 4 which can be used by:
- Loop 1 Time Time Duplex - Cool Output
- Loop 2 Time Simplex Output
- Alarm 4
- Logic Gates

Any use of these outputs will also trigger this Digital Input.

Digital input 3, 4, 5, 6 Action on closure

Table 5-36 lists the configuration prompt selections, the "Action on Closure", and the display indication for each selection available.

Table 5-36 Digital Input 3, 4, 5, 6 Option Action on Contact Closure

DIG IN3, DIG IN4, DIG IN5, DIG IN6 selections	Display Indication	Action on contact closure*
To MANUAL	"MAN" blinks	Puts the controller into manual mode.
To SP1	"SP" blinks	Selects the local setpoint.
To SP2	"SP2" blinks	Selects the second local setpoint.
To SP3	"SP3" blinks	Selects the third local setpoint.
To RUN	"R" indicator blinks	Starts a stopped SP Ramp.
ToHOLD	"H" blinks	Suspends setpoint ramp.
ToPID2	PID2 in lower display	Selects PID2.
PV IS IN1	I IN blinking	Selects the PV to equal Input 1.

Table 5-32 continued on next page

Digital input 3, 4, 5, 6 Action on closure , continued

Table 5-36 Digital Input 3, 4, 5, 6 Option Action on Contact Closure, continued

DIG IN3, DIG IN4, DIG IN5, DIG IN6 selections	Display Indication	Action on contact closure*
PV IS IN2	II IN blinking	Selects the PV to equal Input 2.
PV IS IN3	III IN blinking	Selects the PV to equal Input 3.
PV IS IN4	IV IN blinking	Selects the PV to equal Input 4.
PV IS IN5	V IN blinking	Selects the PV to equal Input 5.
RSP - IN1	“RSP” blinks	Selects Input 1 as Remote Setpoint
RSP - IN2	“RSP” blinks	Selects Input 2 as Remote Setpoint
RSP - IN3	“RSP” blinks	Selects Input 3 as Remote Setpoint
RSP - IN4	“RSP” blinks	Selects Input 4 as Remote Setpoint
RSP - IN5	“RSP” blinks	Selects Input 5 as Remote Setpoint
To DIRECT	“1” or “2” blinks	Selects direct controller action.
MANFSAFE	“MAN” blinks	Unit goes to Manual Mode, output goes to the Failsafe value.
TO A/M STA	“LSP2” Lights	When the switch is closed, the loop performs as follows: PV = In2 Action = Direct Control Algorithm = PD+MR PIDSET = 2 SP = LSP2
TO PURGE	“MAN” blinks	When the switch is closed, both loops are forced to Manual mode with the Output values set to the *High Output Limit*. The loops can only be returned to the Automatic mode by pressing the MAN/AUTO key on the front panel. This a momentary switch input, therefore, no action occurs when the switch is opened.
LOW FIRE	“MAN” blinks	When the switch is closed, both loops are forced to Manual mode with the Output values set to the *Low Output Limit*. The loops can only be returned to the Automatic mode by pressing the MAN/AUTO key on the front panel. This a momentary switch input, therefore, no action occurs when the switch is opened.

*Returns (toggles) to original state when contact opens - except when overruled by the keyboard.

**Open contact selects upward direction.

5.19 Fuzzy Overshoot Suppression

Introduction

Fuzzy Overshoot Suppression minimizes overshoot after a setpoint change or a process disturbance. This is especially useful in processes which experience load changes or where even a small overshoot beyond the setpoint may result in damage or lost product.

How it works

The fuzzy logic observes the speed and direction of the PV signal as it approaches the setpoint and temporarily modifies the internal controller response action as necessary to avoid an overshoot. There is no change to the PID algorithm, and the fuzzy logic does not alter the PID tuning parameters. This feature can be independently Enabled or Disabled as required by the application to work with "TUNE" On-Demand tuning or the "SP" tuning algorithm.

Configuration

To configure this item, refer to Section 3 - Configuration:

- Set Up Group "**ACCUTUNE**"
- Function Prompt "**FUZZY**"
- Select "**ENABLE**" or "**DISABLE**" (▲ or ▼)

5.20 Accutune™

Introduction

There are several types of Accutune from which to choose:

• **(TUNE) Demand Tuning** - Tuning is done on demand by:
- pressing the [Lower Display] and [▲] keys simultaneously, or
- by selecting prompt "TUNE RUN" in the lower display, or
- via Digital Input.

• **(SP Only) Setpoint Tuning** - SP Only tuning will continually adjust the Gain or Proportional Band (P), Reset (I), and Rate (D) tuning constants in response to setpoint changes.

• **(TUNE) Demand Tuning + PV Adapt** - provides "TUNE" On Demand tuning plus "PV" adaptive tuning whenever a PV process disturbance of 0.3% span or greater occurs.

• **(SP Only) Setpoint Tuning+ PV Adapt** - provides "SP Only" tuning plus "PV" adaptive tuning whenever a PV process disturbance of 0.3% span or greater occurs.

Configuration

To configure this item, refer to Section 3 - Configuration:
• Set Up Group "**ACCUTUNE**"
• Function Prompt "**ACCUTUNE**" or "**ACCUTUNE 2**" depending on
which loop you are tuning.
• Select "**DISABLE**", "**TUNE**", "**SP Only**", "**TUNE + PV**", or "**SP Only + PV.** USE(▲ or ▼)

If "**SP Only**" Selected:
- Enter the Setpoint Change Value, Function Prompt "SP CHANG(2)"
- Verify or change the Process Gain Value, Function Prompt "KPG(2)"
- Verify Criteria, Function Prompt "CRITERIA(2)"

Two loop and cascade operation

Accutune II can be used on either or both loops. However, while one loop is operating **SP Only** tuneing, the configuration of either loop cannot be changed.
When one loop is operating by **PV** adaptine tuning, the other loop can have its configuration changed.

Continued on next page

Rules and regulations Table 5-37 is a list of rules and regulations for Accutune.

Table 5-37 Accutune Rules and Regulations

TUNE	SP Only	Applicable Rule or Regulation
X		**TUNE** (On Demand) tuning will work for all Control Algorithms except “On/Off”.
X		**TUNE** (On Demand) tuning works for Integrating Processes.
	X	**SP** tuning will work only for algorithms PID-A or PID-B selections, i.e. it will **NOT** work with ON/OFF, THREE POSITION STEP, or PD+MR control algorithms.
	X	**SP** tuning can tune on all Local or Computer setpoints *except ramping setpoints,* i.e. cannot be done during SP Ramp or SP Program or when using Remote Setpoint.
X	X	Tuning is done in Automatic mode.
X	X	Tuning can be monitored or re-configured using communications option.
X	X	Tuning can be enabled via Digital Inputs.
X	X	Tuning can be aborted by going to Manual mode or disabling via configuration.
X	X	When tuning is in progress, a large “T” appears in the upper display and disappears as soon as tuning is completed.
X	X	can tune two independent loops

Continued on next page

How TUNE (Demand") tuning works

TUNE tuning provides virtually foolproof, trouble-free on-demand tuning in the UDC6300 controller. No knowledge of the process is required at start-up. The operator simply enters the desired setpoint and initiates the tuning.

The UDC controller immediately starts controlling to the setpoint while it identifies the process, calculates the tuning constants and enters them into the Tuning group, and begins PID control with the correct tuning parameters. This works with any process, including integrating type processes, and allows retuning at a fixed setpoint.

The tuning sequence will cycle the controller's output two full cycles between 0% and 100 % (or configured output limits) while allowing only a very small Process Variable change above and below the SP during each cycle.

The algorithm then calculates new tuning parameters and enters them into the tuning group. A large "T" appears in the upper display

Starting TUNE (Demand) tuning

After "TUNE" or 'TUNE+PV" has been enabled, use the procedure in Table 5-38 to start tuning

Table 5-38 Procedure for Starting TUNE (Demand) Tuning

Step	Action
1	Set the Setpoint to the desired value.
2	Switch to "Automatic" mode - Manual/Auto key.
3	Initiate Tuning by: • pressing the ▲ key when the Lower Display prompt = "TUNE-OFF", • pressing the Lower Display and ▲ keys simultaneously, or • using the Digital Input (if configured).

Aborting Tuning

If it is necessary to stop or abort the tuning process, press the Manual/Auto key and the controller will return to Manual mode.

You can also disable "TUNE" OR "TUNE + PV" in the "ACCUTUNE" OR "ACCUTUNE2" set up group.

Continued on next page

TUNE for Duplex (Heat/Cool)

"TUNE" can be done for applications using Duplex (Heat/Cool) control. During tuning, Accutune II requires SP 1 will cause a Heating demand, and then the calculated tuning parameters will be automatically entered as PID SET 1. Likewise, it requires tuning at Local SP 2 will cause a Cooling demand, and the cooling parameters will be entered as PID SET 2.

The tuning sequence will cycle the controller's output two full cycles between the high output limit and 50% for HEAT or between 50% and the low output limit for COOL while allowing only a small process variable change above and below the setpoint during each cycle.

Configuring TUNE for Duplex (Heat/Cool)

To configure this item, refer to Section 3 - Configuration:

- Set Up Group "**ACCUTUNE**"
- Function Prompt "**ACCUTUNE**" OR "**ACCUTUNE2**"
- Select "**TUNE**" OR "**TUNE+PV**". Use (▲ or ▼)

Using TUNE at Start-up for Duplex (Heat/Cool)

After "TUNE" or "TUNE+PV" has been enabled, use the procedure in Table 5-39 to use "TUNE" at Start-up for Duplex (Heat/Cool) control.

Table 5-39 Procedure for Using TUNE at Start-up for Duplex

Step	Action
1	***Heat Zone:*** **a**. Adjust the **Local SP1** to a value within the **Heat** Zone. **b**. Insure that the UDC is in *Automatic* mode. **c**. Press the [Lower Display] and [▲] keys simultaneously to initiate **Heat** tuning. The output will cycle between 50% and 100% (or high output limit). A large "T" appears in the upper display until tuning is completed and final **Heat** parameters are entered for **PID Set 1** in the Tuning group.
2	***Cool Zone:*** **a**. Adjust the **Local SP2** to a value within the **Cool** Zone. **b**. Insure that the UDC is in *Automatic* mode. **c**. Press the [Lower Display] and [▲] keys simultaneously to initiate **Cool** tuning. The output will cycle between 0% and 50% (or low output limit). A large "T" appears in the upper display until tuning is completed and final **Cool** parameters are entered for **PID Set 2** in the Tuning group.

Continued on next page

How "SP Only" Tuning works

"SP Only" tuning will continually adjust the Gain or Proportional Band (P), Reset (I), and Rate (D) tuning constants in response to setpoint changes.

SP Only tuning handles all Local and Computer Setpoint changes. It uses time domain analysis, and the rule based expert system techniques to identify the two most dominant process lags plus any dead time.

It then automatically readjusts the PID parameters as necessary. It does this while controlling to setpoint in automatic (closed loop) control mode.

These calculated PID values can be changed, if desired, by disabling SP Tune and entering different values.

Tuning can be aborted by pushing [Manual] key to return to manual mode.

Two criteria are available — "Normal" and "Fast" through configuration.

Setpoint changes

During start-up, or whenever the setpoint changes beyond the "SP Change" value, SP Only tuning employs time domain analysis to tune the process at any desired setpoint without any prior initialization or process knowledge.

Using SP Only tuning at Start-up

After "SP Only" or "SP Only + PV" has been enabled, use the procedure in Table 5-40 to use "SP Only" tuning at Start-up.

Table 5-40 Procedure for Using SP Only Tuning at Start-up

Step	Action
1	Put the controller into manual mode- [Manual/Auto] key.
2	Let the PV stabilize.
3	Adjust the Setpoint to the desired value.
4	Put the controller into automatic mode- [Manual/Auto] key. The controller will switch to automatic mode and the process will start to move toward the setpoint and will line out with the proper tuning constants. A large "T" appears on the left side of the upper display to indicate that (SP) tuning is in progress.

Continued on next page

SP Only Tuning for Duplex (Heat/Cool)

"SP Only" tune can be done for applications using Duplex (Heat/Cool) control.

Configuring SP Only Tuning for Duplex (Heat/Cool)

To configure this item, refer to Section 3 - Configuration:

- Set Up Group "ACCUTUNE"
- Function Prompt "ACCUTUNE" or "ACCUTUNE2"
- Select "SP Only" or SP Only + PV". Use (▲ or ▼)
- Enter the Setpoint Change Value, Function Prompt "SP CHANG" or "SPCHANG2".
  - Verify the Process Gain Value to be 1.0, Function Prompt "KPG" or "KPG2"
  - Verify Criteria selected is "FAST", Function Prompt "CRITERIA" or "CRITERIA2"

Using SP Only tuning at Start-up for Duplex (Heat/Cool)

After "SP Only" or "SP Only + PV" has been enabled, use the procedure in Table 5-41 to use "SP" tuning at Start-up for Duplex (Heat/Cool) control.

Table 5-41 Procedure for Using SP Tuning at Start-up for Duplex

Step	Action
1	Put the controller into manual mode- Manual/Auto key.
2	***Heat Zone:*** **a**. Adjust the output to a value ABOVE 50% and at least 5% lower than the normal Heating Setpoint value. **b**. Let the PV stabilize. **c**. Press the Manual/Auto key to start tuning for Heat Zone. The controller will switch to automatic mode and the process will start to move toward the setpoint and will line out with the proper HEAT tuning constants. A large "T" appears on the left side of the upper display to indicate that (SP) tuning is in progress. When the "T" disappears, tuning is completed and final values are entered for PID Set 1 parameters in the Tuning group.
3	***Cool Zone:*** **a**. Adjust the output to a value BELOW 50% and at least 5% above the normal Cooling Setpoint value. **b**. Let the PV stabilize. **c**. Press the Manual/Auto key to start tuning for Cool Zone. The controller will switch to automatic mode and the process will start to move toward the setpoint and will line out with the proper COOL tuning constants. A large "T" appears on the left side of the upper display to indicate that (SP) tuning is in progress. When the "T" disappears, tuning is completed and final values are entered for PID Set 2 parameters in the Tuning group.

Continued on next page

SP Only tuning (after Start-up)

SP Only tune will occur whenever the controller is in automatic mode and a setpoint change occurs which is greater than the previously configured minimum setpoint change value.

The controller will delay using any setpoint changes for 30 seconds to enable it to calculate whether to "SP" tune or not. But, if the controller is toggled between LSP1 and LSP2 or if any other key (such as LOWER/DISPLAY) is pressed, the setpoint change is immediate.

A large "T" is displayed in the upper display whenever tuning is in progress. During this time, no changes to the configuration parameters, including the setpoint, are permitted.

Aborting SP Only Tuning

If it is necessary to stop or abort the tuning:

• press the [Manual/Auto] key to return to Manual mode. This will cause an immediate abort of tuning.

• Disable "SP Only" or "SP Only + PV" in the Accutune Set Up group at function prompt "ACCUTUNE" or "ACCUTUNE2".

Re-Tuning

The controller will evaluate current tuning as SP changes occur. When re-tuning is required, the controller operates in automatic mode and identifies new tuning constants.

At that point, the "T" disappears and tuning values are entered and used until re-tuning occurs again.

Continued on next page

TUNE+PV ADAPT or SP+PV ADAPT (Process variable disturbances)

The (TUNE) Demand Tuning or the (SP Only) Setpoint Tuning portions of these selections work as stated previously.

During Process Variable (PV) disturbances which result from non-linearities, process dynamics, load changes or other operating conditions, **PV ADAPT** will occur whenever a PV disturbance of 0.3% span or larger occurs. When this condition exists, the controller monitors the process response to determine whether there has been a true process change or a momentary upset. It will take 1 and 1/2 process cycles around the setpoint before any process recognition can occur.

For this configuration, the controller operates with only one set of Tuning Parameters for each loop. The second set, normally used for Duplex Output or for Keyboard, PV or SP Switching, is not used because Adaptive Tune continually updates the tuning parameters based on the PV deviation.

PV tuning indications

A **small "T"** is displayed in the upper display whenever PV ADAPT mode is in progress. During this time, changes to the configuration parameters are permitted. However, this may cause the PV ADAPT process to abort.

The selection of Fast or Normal criteria has no effect on PV Adapt.

Aborting PV Adaptive Tuning

If it is necessary to stop or abort the tuning:

• press the [Manual/Auto] key to return to Manual mode. This will cause an immediate abort of tuning.

• Disable "TUNE+PV" or "SP Only + PV" in the Accutune Set Up group at function prompt "ACCUTUNE" or "ACCUTUNE2".

Continued on next page

Error prompt accessing procedure

When an error is detected in the Accutune process, the message “AT ABORT” will appear in the lower display.

In order to determine what is causing the error:

- Select “ACCUTUNE” or “ACCUTUNE2” Set Up Group
- Access function prompt “AT ERROR” or “AT ERR2” for error prompt.

Table 5-30 lists the Accutune error codes that will be displayed in the **Upper Display** and their definitions.

Error prompt

Table 5-42 lists the Adaptive Tune error prompts and their definitions.

Table 5-42 Adaptive Tune Error Prompt Definitions

Upper Display Prompt	Prompt Definition	Action to Take
NONE	NO ERRORS	None
OUTLIMIT	SP Adapt step is greater than high output limit or less than low output limit Output step insufficient to get to SP Value	• Check the output limits under Set Up group prompt “CONTROL”, function prompts “OUTHILIM” and “OUTLOLIM” in *Section 3 - Configuration*. • Check “PROCESS GAIN” . Refer to Table 5-36.
IDFAIL	Process Identification Failure A illegal value of gain, Rate, or reset was calculated.	Try to SP tune again.
ABORT **(Only error code available for “TUNE”)**	• Manual abort has occurred – Accutune will abort if the MAN/AUTO key is pressed during tuning • Digital Input detected • Automatic Abort has occurred – Accutune will automatically abort when a PV oscillation has been detected during “SP ADAPT”, whenever any SP values are changed during a “PV ADAPT”, or when Accutune is disabled.	Try to TUNE or SP tune again.
LOW PV	PV not changed sufficiently or the PV has increased by more than 4% and Deadtime not determined.	NONE - After a period of about 5 minutes, the “SP Ony” will be re-tried automatically with a larger output step.
RUNNING	Informational prompt indicating that “SP Only” is still active checking process gain even though “T” is not lit. It does not affect the keyboard operation.	None

5.21 Input 5 - Pulse Input

Introduction

This pulse input counts pulses sent from a 2-wire, 3-wire, or externally powered external pulse device. The circuit is on an optional printed wiring board which mounts to the Digital I/O board. This option is mutually exclusive with the low level input board.
The input can be used as either a frequency input or as a pulse input. The pulse input can be a pulse train or a method of adjusting the Remote setpoint value up or down. Minimum Span = 100Hz; Resolution:±5Hz.

Frequency Input

This selection is normally used with frequency output devices, such as Turbine Flowmeters. For this configuration, the controller counts the number of pulses received over 1/3 second period then multiplies this value by three to convert to Hertz (cycles per second). This conversion is done so that the pulse input will operate at the same Loop sample rate as the rest of the controller. The frequency range is 0 to 25,000 Hz maximum and
0–100 Hz Minimum Span.

Pulse Input

There are two pulse input selections from which to choose:

- REMOTE SETPOINT PULSE TRAIN - The controller counts the total number of pulses received, scales the value of each pulse by the calibration values and the Input 5 High and Low range values, and then sets the remote setpoint (RSP). For example: If the pulse input was calibrated for 0 Hz (zero value) to 10,000 Hz (span Value) and the Input 5 high and low range values were 1000 and 0 respectively, then each individual pulse would be equal to 1000 divided by 10000 or 0.1. So if a pulse train sent to the controller contained 1581 pulses, then the RSP would be set to 158.1.

  While the controller is receiving a pulse train, the RSP will remain steady at the last received value until the pulse train has ended. At that point, the RSP is calculated and set as shown above. A pulse train is defined to have ended after a minimum of 2/3 seconds have elapsed with no pulses received. At this point, the RSP is calculated and used in control equations, so that any new pulses received are interpreted as being the start of a new pulse train.

- REMOTE SETPOINT ADJUST PULSE UP/DOWN - The controller adjusts the current RSP value up or down by counting the number of pulses received and scaling the total as shown in the pulse train example. Digital Input #1 must be used to select the desired direction of change. Each pulse adjusts the RSP value up or down — depending on the Digital input status (closed = pulse down, or open = pulse up) — in increments calculated as in the pulse train example. The RSP is calculated and set every 1/3 second while pulses are being received.

Wiring

Make sure the controller is wired to an external pulse device as shown in the wiring diagrams in *Section 2 - Installation*.

Continued on next page

Configuration

Configure your controller for the type of pulse input required (See table 5-43). Press the [SETUP] key until you get the set up group prompt you want, then press the [FUNC] key until you see the required function group prompt in the lower display.
Use the ▲ or ▼ keys to change the value or make you selection in the upper display.

Table 5-43 Controller Configuration Selections for Pulse Input

Pulse Operation Selection	Set Up Group Prompt (Lower Display)	Function Group Configuration Prompt (Lower Display)	Selection (Upper Display)
Frequency Input	INPUT_5	IN5_PULSE	FREQ_INP
Pulse Train (Loop 1 shown)	INPUT_5	IN5_PULSE	PULSE
	INPUT_5	IN_5_HIGH	(same as PV high)
	INPUT_5	IN_5_LOW	(same as PV low)
	CONTROL	RSP_SOURCE	INPUT_5
	OPTIONS	DIG_IN_1	(any selection except PULSE DOWN)
	OPTIONS	DIG_IN_2	(any selection except PULSE DOWN)
Pulse Up/Down (Loop 1 shown)	INPUT_5	IN5_PULSE	PULSE
	INPUT_5	IN_5_HIGH	(same as PV high)
	INPUT_5	IN_5_LOW	(same as PV low)
	CONTROL	RSP_SOURCE	INPUT_5
	OPTIONS	DIG_IN_1	PULSE DOWN
	OPTIONS	DIG_IN_2	(any selection except PULSE DOWN)

5.22 Three Position Step Control

Introduction

The Three Position Step Control algorithm allows the control of a valve (or other actuator) with an electric motor. Digital Outputs 3 and 4 generate control signals that drive external relays; one to move the motor upscale, the other to move it downscale, without a feedback slidewire linked to the motor shaft. Adaptive Tune does not function with this algorithm.

How it works

Three Position Step control is an extension of the On-Off Duplex Control to include internal feedback of the state of the Digital Outputs.

In this algorithm, the error signal is compared with a feedback signal and the result determines the state of the Digital Outputs as follows:

Positive Error > Feedback	Digital Output 3 On
Negative Error < Feedback	Digital Output 4 On

Otherwise, the outputs are both off.

Estimated motor position

The Three Position Step control algorithm provides an output display ("OUT") which is an estimated motor position since the motor is not using any slidewire feedback.

Although this output indication is only accurate to a few percent, it is corrected each time the controller drives the motor to one of its stops (0% or 100%).

It avoids all the control problems associated with the feedback slidewire (wear, dirt, noise).

When operating in this algorithm, the estimated "OUT" display is shown to the nearest percent (i.e. no decimal).

Setting the motor travel time

Table 5-44 lists the procedure for setting the motor time. This is the time it takes the motor to travel from 0% to 100%.

Table 5-44 Procedure for Setting the 3PSTEP Motor time

Step	Operation	Press	Action
1	Enter the Set Up mode	**SET UP**	Until you see: Upper Display SET UP Lower Display ALGORTHM
2	Select 3PSTEP	**FUNC L1/L2**	Until you see: Upper Display [ ] ← Current Selection Lower Display CONTR ALG
		▲ or ▼	To select "**3PSTEP**" in the upper display

Continued on next page

5.22 Three Position Step Control, Continued

Setting the motor travel time, continued

Table 5-44 Procedure for Setting the 3PSTEP Motor time, continued

Step	Operation	Press	Action
3	Enter the Motor Travel Time	**FUNC L1/L2**	Until you see: Upper Display: (Motor Time in seconds) Lower Display: MTR TIME
		▲ or ▼	To select the Motor Travel Time. Range of setting: 5 to 255 seconds

Displaying the motor position

Table 5-45 lists the procedure for displaying the motor position.

Table 5-45 Procedure for Displaying the 3PSTEP Motor Position

Step	Operation	Press	Action
1	Access the displays	**LOWR DISP**	Until you see: Upper Display: The PV value Lower Display: **OUT** and the estimated 3PStep motor position in percent.

Power up output

When the controller powers up after a power outage, the position of the motor will correspond to whatever was configured at set up group prompt “CONTROL”, function prompt “PWR MODE”, selection MANUAL, AorM SP, or AorM LSP. Refer to Subsection 4.11, Table 4-10 for definition of each selection.

If Burnout = NONE is configured for the PV Input, the FAILSAFE output value in the “CONTROL” group must be configured for 0% or 100%.

5.23 Auto/Manual Station

Introduction

When you select "AM STA" (auto manual station) under "OPTION" setup group, function prompt "DIG IN1", "DIG IN2", "DIG IN3", "DIG IN4", "DIG IN5", or "DIG IN6" (digital input options), contact closure on the selected digital input causes the controller to switch to Auto/Manual Station mode.

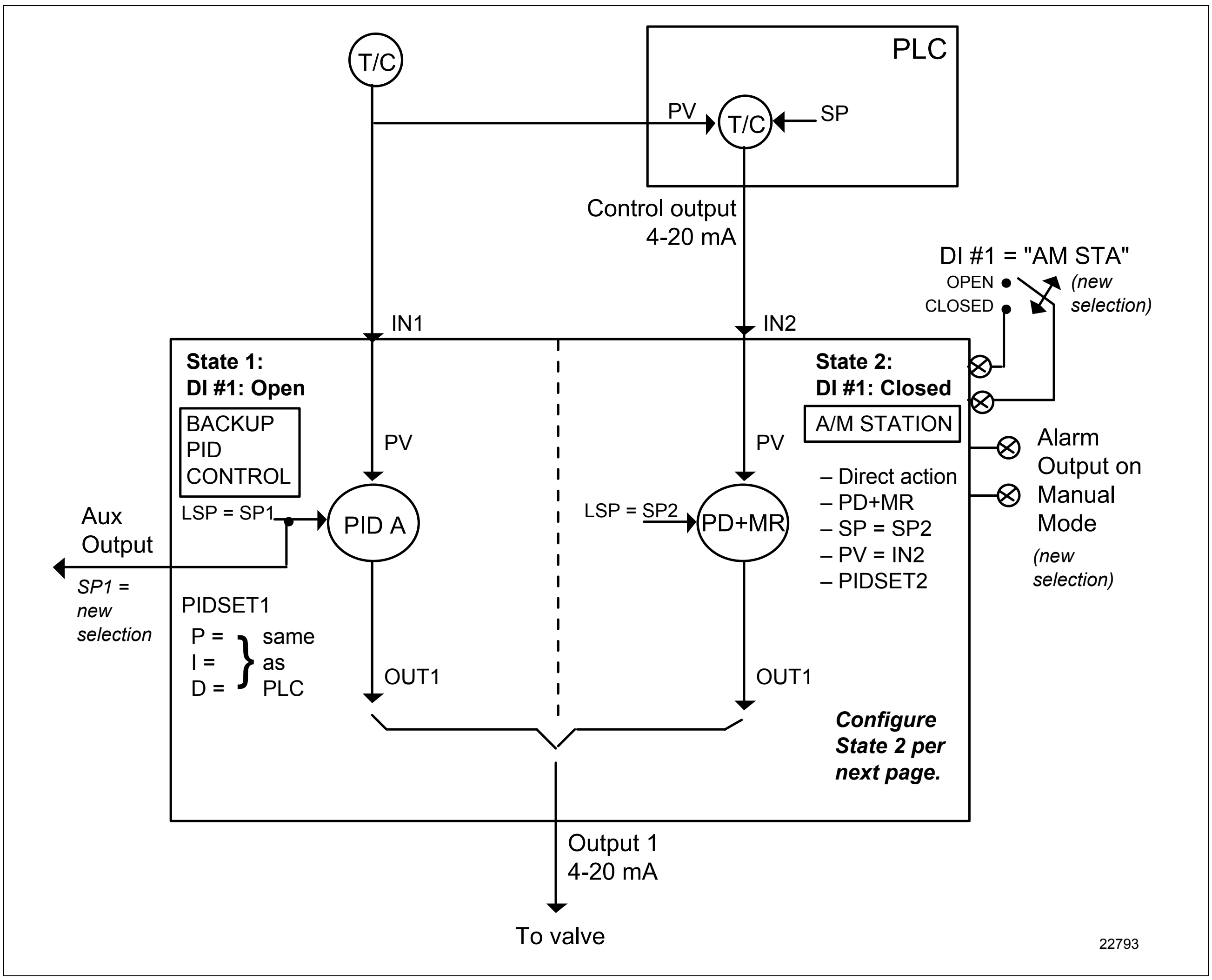
Function

As shown in Figure 5-5, State 2 is the "A/M Station mode" where the programmable logic controller (PLC) output is sent through the Auto/Manual Station. You can switch to manual and change the output at the controller. (It uses PIDSET2.)

State 1 is the "Backup PID mode" which is triggered by opening the Digital Input. (It uses PIDSET1.)

Figure 5-5 is an example using DIG IN 1 as the selection under "OPTIONS" Set Up Group.

Figure 5-5 Auto/Manual Station Using Digital Input #1 and Backup Control Feature



Continued on next page

Description

The “AM STA” selection of digital input creates a repeater station when the digital input is closed. This is accomplished by a multi-selection from the digital input menu.

- “ACTION” is forced as “DIRECT”.
- “CONT ALG” is forced as “PD+MR”.
- Active setpoint is forced to LSP2.
- The PV is switched to “PV 2IN”.
- The tuning parameters used are the second set of parameters.

When the switch is open the unit becomes a normal controller with “CONT ALG” of “PID A”, using tuning parameters set 1, LSP1, PV as IN1 and “DIRECT” or “REVERSE” as selected by customer configuration.

Input 1 is typically the PV of some upper controller and Input 2 is typically that controller’s output.

If the upper control fails, the upper device or some watch dog opens the digital input switch and UDC 6300 back-up PID A control is active.

When the upper control reactivates, the digital input switch is closed and the Auto/Manual Station becomes a repeater station and allows the upper control output signal to pass through.

Configuration

There are some things to consider when configuring the controller.

The PV range stays as the IN1 range, even while IN2 is the PV when the switch is closed, therefore:

- The IN2 HI must be less than or equal to the IN1 HI.
  (Suggest: IN2 HI = 100.0)
- The IN2 LO must be greater than or equal to the IN1 LO.
  (Suggest: IN2 LO = 0.0)
- The TUNING GAIN2 must be equal to
  (IN1 HI – IN1 LO) / (IN2 HI – IN2 LO).

Continued on next page

Configuration (continued)

Refer to Table 5-46 and set up the controller in the order shown.

Table 5-46 Auto/Manual Station Mode Configuration Procedure

Step	Press SET UP to Select Setup Group	Press FUNC to Select Function Prompts	Press s t Enter Value or Selection	Remarks
1	**Control**	PID SETS	2 KEYBD	Select other control parameters as needed by the application.
		LSP's	TWO	
		SP TRACK	NONE	
2	**Algorithm**	CONTR ALG	PD+MR	This allows setting of the Manual Reset value.
3	**Tuning**	MAN RESET	0	Manual Reset of 0 for no output Bias and requires LSP2=0%. If Bias is required, set MR to equal the desired output Bias value.
4	**Algorithm**	CONT ALG	PID A	Defines Back-up Control Algorithm.
5	**Tuning**	RSET2MIN	50.00	
		GAIN2	See Note 1	Note 1. Set the Gain 2 equal to $\frac{\text{Input 1 Span}}{\text{Input 2 Span}}$ If "PB" is selected under "Control" setup group, function prompt "PBorGAIN", set the PROP BD2 to $100 \times \frac{\text{Input 2 Span}}{\text{Input 1 Span}}$
		RATE2MIN	0.00	Select PIDSET1 tuning parameters as needed by the application.
6	**Options**	DIG IN1 through DIG IN 6	AM STA	

CAUTION

DO NOT SELECT

- In the CONTROL setup list, do not select SP TRACK as PV or RSP.
- In the SP RAMP setup list, do not select SP RATE as ENABLE.
- In the ALGORTHM setup list, do not select CONT ALG as PID B, ON-OFF, or 3PSTEP.
- In the Display menu when PIDSET# is displayed, DO NOT change the selection.

Continued on next page

Operation

Set the Local Setpoint 2 to 0% of the Input 2 range.

These features work with the Auto/Manual Station.

- In the SP RAMP setup list, SP PROG (acts on SP1 for backup operation).
- In the SP RAMP setup list, SP RAMP (acts on SP1 for backup operation).
- In the CONTROL setup list, ACTION as DIRECT or REVERSE for the backup PID A operation.

  The PD+MR Action is forced to be DIRECT as required for the pass through of the output signal.

Section 6 – Input Calibration

6.1 Overview

Introduction

This section describes the field calibration procedures for Input 1, Input 2, Input 3, Input 4, and optional Input 5.

Every UDC 6300 controller contains all input actuation ranges fully factory calibrated and ready for configuration to range by the user.

However these procedures can be implemented if the factory calibration of the desired range is not within specifications.

Note that the field calibration on Input 5 will be lost if a change in input type configuration is implemented at a later time. The original factory calibration data remains available for later use after a field calibration is done.

To restore Factory calibration on any of the inputs, refer to Subsection 6.12.

What's in this section

This section contains the following topics:

Topic		See Page
6.1	Overview	217
6.2	Minimum and maximum range values	218
6.3	Input 1, 2, 3, and 4 Preliminary Information	219
6.4	Input 1, 2, 3, and 4 Set Up Wiring	221
6.5	Input 1, 2, 3, and 4 Calibration Procedure	222
6.6	Input 5 Low Level Inputs Preliminary Information	224
6.7	Input 5 Low Level Inputs Set Up Wiring	226
6.8	Input 5 Low Level Inputs Calibration Procedure	230
6.9	Input 5 Pulse Input Preliminary Information	232
6.10	Input 5 Pulse Input Calibration Procedure	233
6.11	Input 5 Pulse Input Verification	235
6.12	Restoring Factory Calibration	236

Calibration steps

Use the following steps when calibrating an input.

Step	Action
1	Find the minimum and maximum range values for your PV input range from Table 6-1.
2	Disconnect the field wiring and find out what equipment you will need to calibrate. DO NOT remove external resistor assemblies (if present).
3	Wire the calibrating device to your controller according to the Set Up wiring instructions for your particular input.
4	Follow the calibration procedure given for Input #1, 2, 3, 4, or 5

6.2 Minimum and Maximum Range Values

Select the range values

You should calibrate the controller for the minimum (0%) and Maximum (100%) range values of your particular sensor.
Calibrate each input separately.
Select the Voltage or Resistance equivalent for 0% and 100% range values from Table 6-1. Use these value when calibrating your controller.

Table 6-1 Voltage and Resistance Equivalents for 0% and 100% Range Values

Sensor Type	PV Input Range		Range Values	
	° F	° C	0%	100%
B Thermocouple	105 to 3300	41 to 1815	0 mV	13.763 mV
E Thermocouple	-454 to 1832	–270 to 1000	–9.835 mV	76.358 mV
J Thermocouple	0 to 1600	–18 to 871	–0.885 mV	50.059 mV
K Thermocouple	0 to 2400	–18 to 1316	–0.692 mV	52.939 mV
NiNiMoly T/C	32 to 2500	0 to 1371	–0.001 mV	71.330 mV
Nicrosil Nisil T/C	0 to 2372	–18 to 1300	–0.461 mV	47.502 mV
R Thermocouple	0 to 3100	–18 to 1704	–0.089 mV	20.275 mV
S Thermocouple	0 to 3100	–18 to 1704	–0.092 mV	17.993 mV
T Thermocouple	-300 to 700	–184 to 371	–5.341 mV	19.095 mV
W5W26 T/C	0 to 4200	–18 to 2316	–0.234 mV	37.066 mV
RTD (IEC=0.00385)				
100 Ohms	-300 to 900	–184 to 482	25.18 Ω	274.96 Ω
100 Ohms (low)	0 to 300	–18 to 149	93.03 Ω	156.90 Ω
200 Ohms	-300 to 900	–184 to 482	50.36 Ω	549.92 Ω
500 Ohms	-300 to 900	–184 to 482	125.90 Ω	1374.80 Ω
Radiamatic (RH)	1400to3400	760 to 1871	0.99 mV	57.12 mV
Milliamps	4 to 20 mA		4 mA	20 mA
Millivolts	0 to 10 mV		0 mV	10 mV
	10 to 50 mV		10 mV	50 mV
Volts	1 to 5 Volts		1 Volt	5 Volts
	0 to 10 Volts		0 Volts	10 Volts

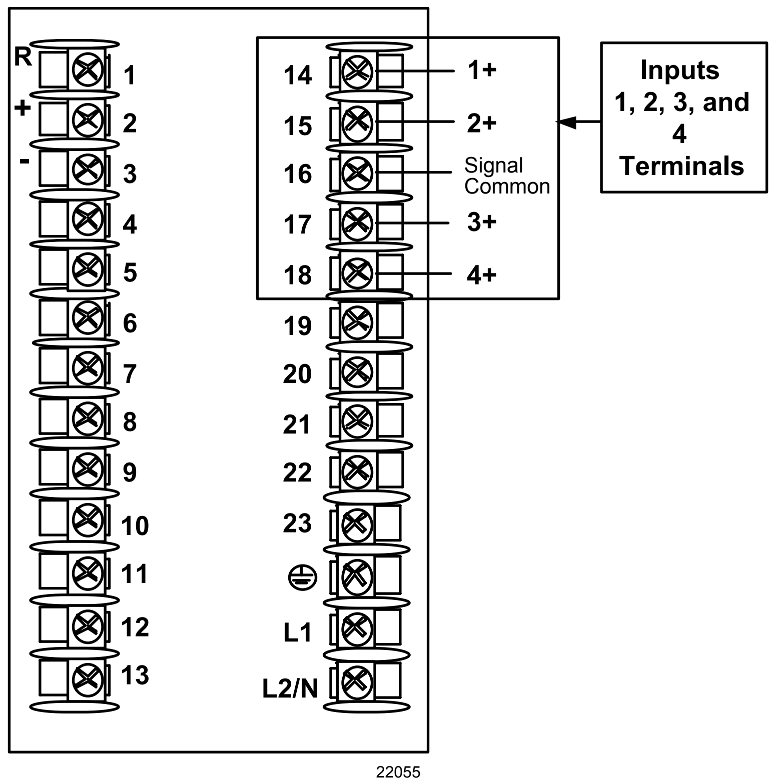
6.3 Input 1, 2, 3, or 4 Preliminary Information

Disconnect the field wiring

Depending on which input (#1, 2, 3, or 4) you are going to calibrate, tag and disconnect any field wiring connected to the input terminals on the rear of the controller.

Figure 6-1 shows the wiring terminal designations for Input #1, 2, 3, or 4

Figure 6-1 Input #1, 2, 3, or 4 Wiring Terminals



Continued on next page

6.3 Input 1, 2, 3, or 4 Preliminary Information, Continued

Equipment needed

Table 6-2 lists the equipment you will need to calibrate the Milliamp or Volt ranges that are available for Inputs 1, 2, 3, or 4. You will need a screwdriver to connect these devices to your controller.

Table 6-2 Equipment Needed

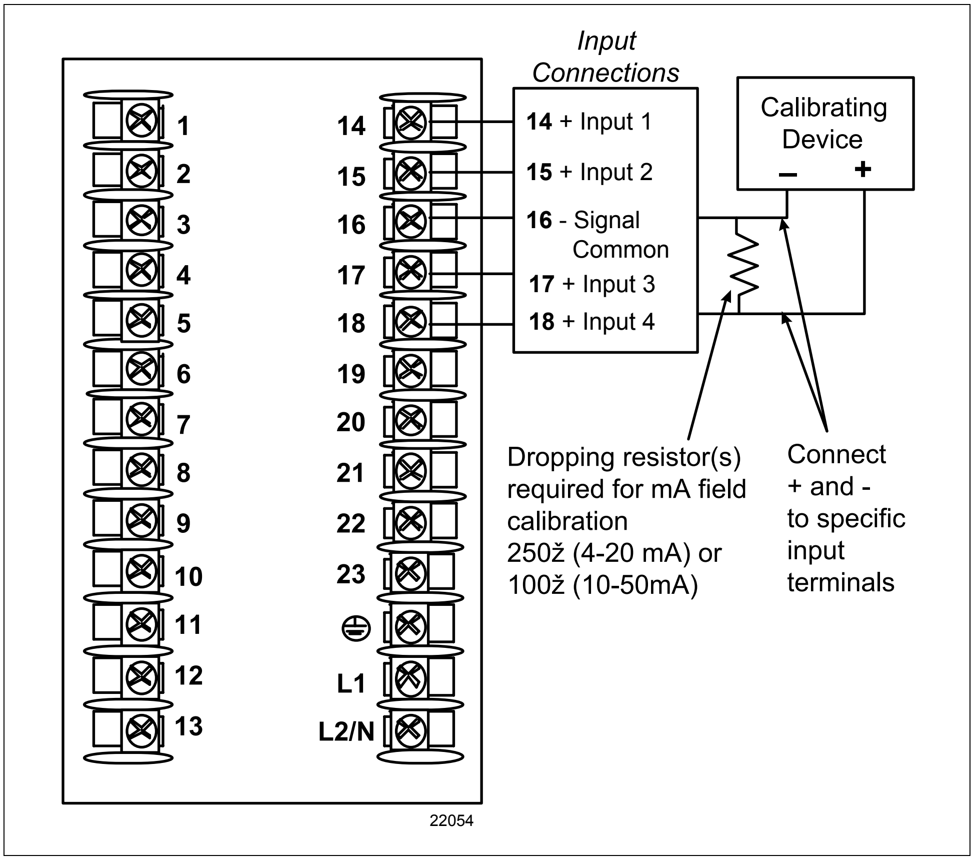
Type of Input	Equipment Needed
Milliampere or Volts	• A calibrating device with ±0.01% accuracy for use as a signal source. • Two insulated copper leads for connecting the calibrator to the controller. • Place current source at zero before switching ON. • Do not switch current sources OFF/ON while connected to the UDC 6300 input.

6.4 Input 1, 2, 3, or 4 Set Up Wiring

1 to 5 Volts or 4–20 mA Inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #1, 2, 3, or 4. See Figure 6-2.

Figure 6-2 Wiring Connections for 1 to 5 Volts or 4 to 20 mA



6.5 Input #1, 2, 3, or 4 Calibration Procedure

Introduction

Apply power and allow the controller to warm up for 1 hour before you calibrate.
Please read "*Set Up Wiring*" before beginning the procedure.
Make sure you have "LOCKOUT" set to "NONE." See *Section 3 – Configuration.*

CAUTION For linear inputs, avoid step changes in inputs. Vary smoothly from initial value to final 100% value.

Procedure

The Calibration procedure is the same for Input #1 and 2, 3, or 4 except that the displays will indicate 2, 3, or 4. The procedure is listed in Table 6-3.

Table 6-3 Input #1, 2, 3, or 4 Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode for the Input selected	SET UP until you see	Upper Display: CALIB Lower Display: INPUT X X = 1, 2, 3, or 4
		FUNC L1/L2	You will see: Upper Display: DISABL Lower Display: CAL INX X = 1, 2, 3, or 4
		▲	The calibration sequence is enabled and you will see: Upper Display: BEGIN Lower Display: CAL INX X = 1, 2, 3, or 4 At the completion of the sequence, the selection automatically reverts to disable.
2	Calibrate 0%	FUNC L1/L2	You will see: Upper Display: APPLY Lower Display: IN1 ZERO X = 1, 2, 3, or 4 Adjust your calibration device to an output signal equal to the 0% range value for your particular input sensor. Wait 15 seconds, then go to the next step.

Table 6-3 continued on next page

Table 6-3 Input #1, 2, 3, or 4 Calibration Procedure, continued

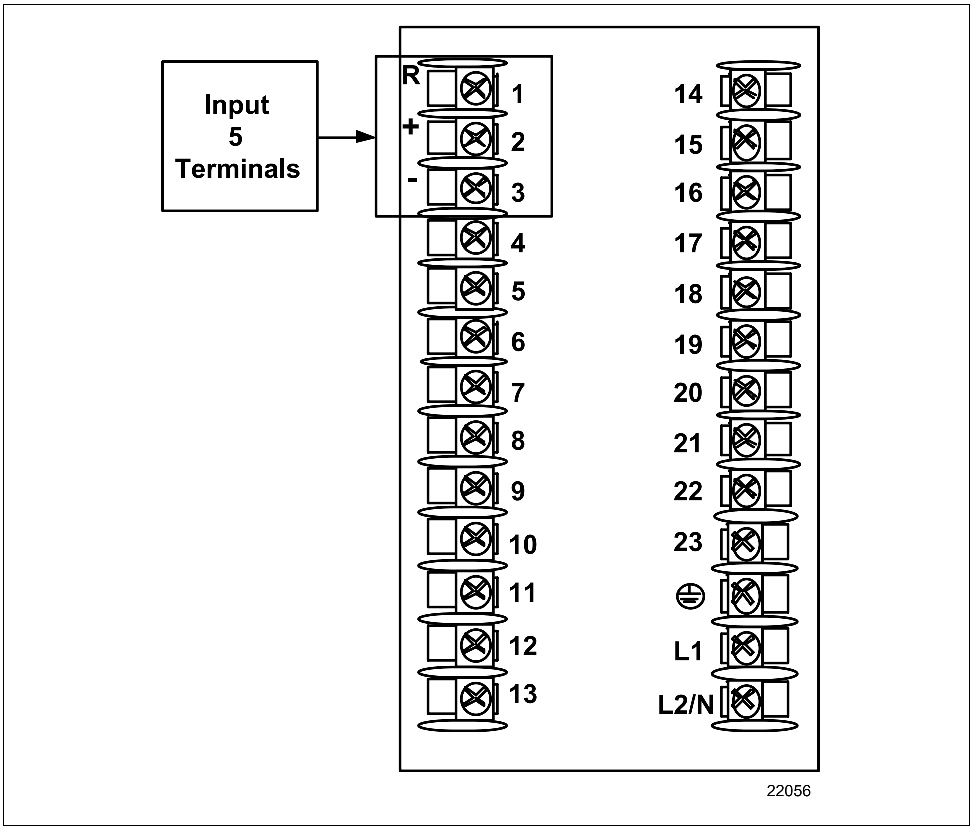
Step	Description	Press	Action
3	Calibrate 100 %	**FUNC L1/L2**	You will see: Upper Display APPLY Lower Display INX SPAN X = 1, 2, 3, or 4 Adjust your calibration device to an output signal equal to the 100% range value for your particular input sensor.
4	Exit the Calibration Mode	**FUNC L1/L2**	The controller will store the calibration constants.
		or **LOWR DISP**	To exit the calibration mode. **ATTENTION** Press the [FUNC/L1-L2] key first to store constants.

6.6 Input 5 - Low Level Inputs Preliminary Information

Disconnect the field wiring

Figure 6-3 shows the wiring terminal designations for Input #5 - Low Level Inputs. Tag and disconnect any field wiring connected to the input terminals on the rear of the controller. Leave field wiring connected to all inputs which are not being field calibrated.

Figure 6-3 Input #5 - Low Level Inputs Wiring Terminals



Continued on next page

Equipment needed

Table 6-4 lists the equipment you will need to calibrate the specific types of inputs that are listed in table 6-1. You will need a screwdriver to connect these devices to your controller.

Table 6-4 Equipment Needed

Type of Input	Equipment Needed
Thermocouple Inputs (Ice Bath)	• A calibrating device with ±0.01% accuracy for use as a signal source such as a millivolt source. • Thermocouple extension wire that corresponds with the type of thermocouple that will be used with the controller input. • Two insulated copper leads for connecting the thermocouple extension wire from the ice baths to the precision calibrator. • Two containers of crushed ice.
Thermocouple Inputs (Precision Resistor)	• A calibrating device with ±0.01% accuracy for use as a signal source such as a millivolt source. • Two insulated copper leads for connecting the calibrator to the controller. • A precision 500 ohm resistor ±0.1% connected across input #5 terminals 1(R) and 3(–).
Thermocouple Inputs (Ambient Temperature)	• A calibrating device with ±0.02% accuracy for use as a signal source such as a millivolt source. • Two insulated copper leads for connecting the calibrator to the controller.
RTD (Resistance Thermometer Device)	• A decade box, with ±0.01% accuracy, capable of providing stepped resistance values over a minimum range of 0 to 1400 Ohms with a resolution of 0.1 ohm. • Three insulated copper leads for connecting the decade box to the controller.
Milliampere, Millivolt, Volts, and Radiamatic	• A calibrating device with ±0.01% accuracy for use as a signal source. • Two insulated copper leads for connecting the calibrator to the controller. • Place current source at zero before switching ON. • Do not switch current sources OFF/ON while connected to the UDC6300 input.

6.7 Input #5 - Low Level Inputs Set Up Wiring

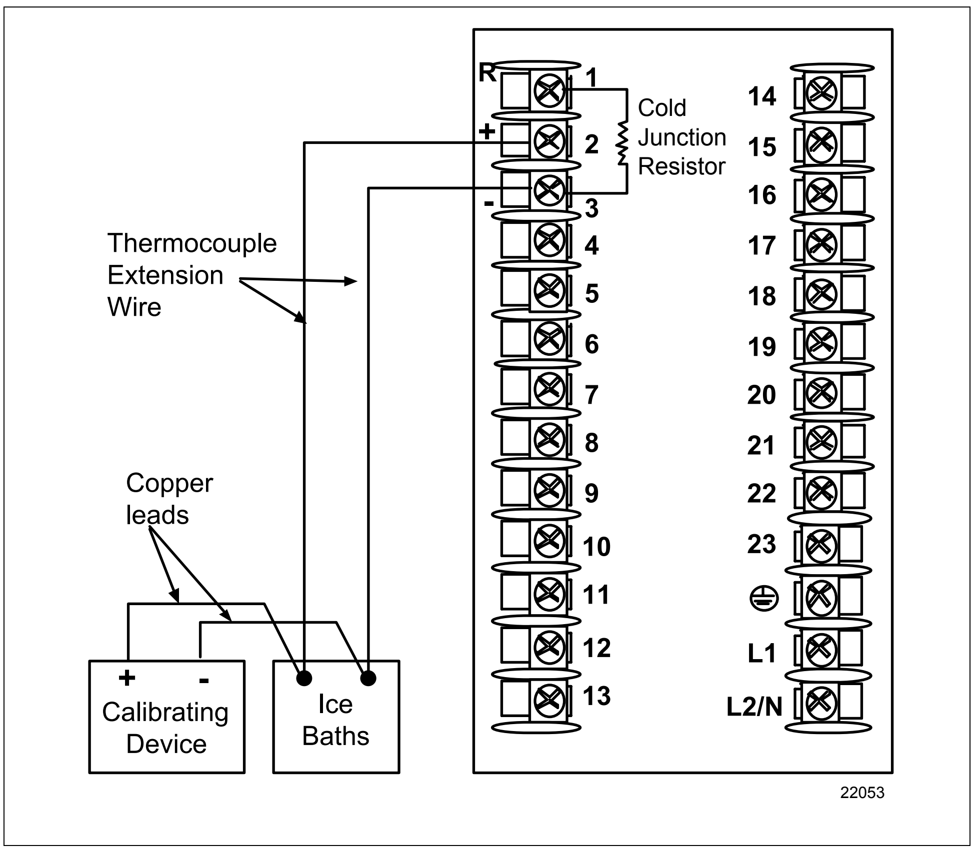
Thermocouple inputs using an ice bath

Refer to Figure 6-4 and wire the controller according to the procedure given in Table 6-5.

Table 6-5 Set Up Wiring Procedure for Thermocouple Inputs Using An Ice Bath

Step	Action
1	Connect the copper leads to the calibrator.
2	Connect a length of thermocouple extension wire to the end of each copper lead and insert the junction points into the ice bath.
3	Connect the thermocouple extension wires to the terminals for Input #5. See Figure 6-4.

Figure 6-4 Wiring Connections for Thermocouple Inputs Using an Ice Bath



Continued on next page

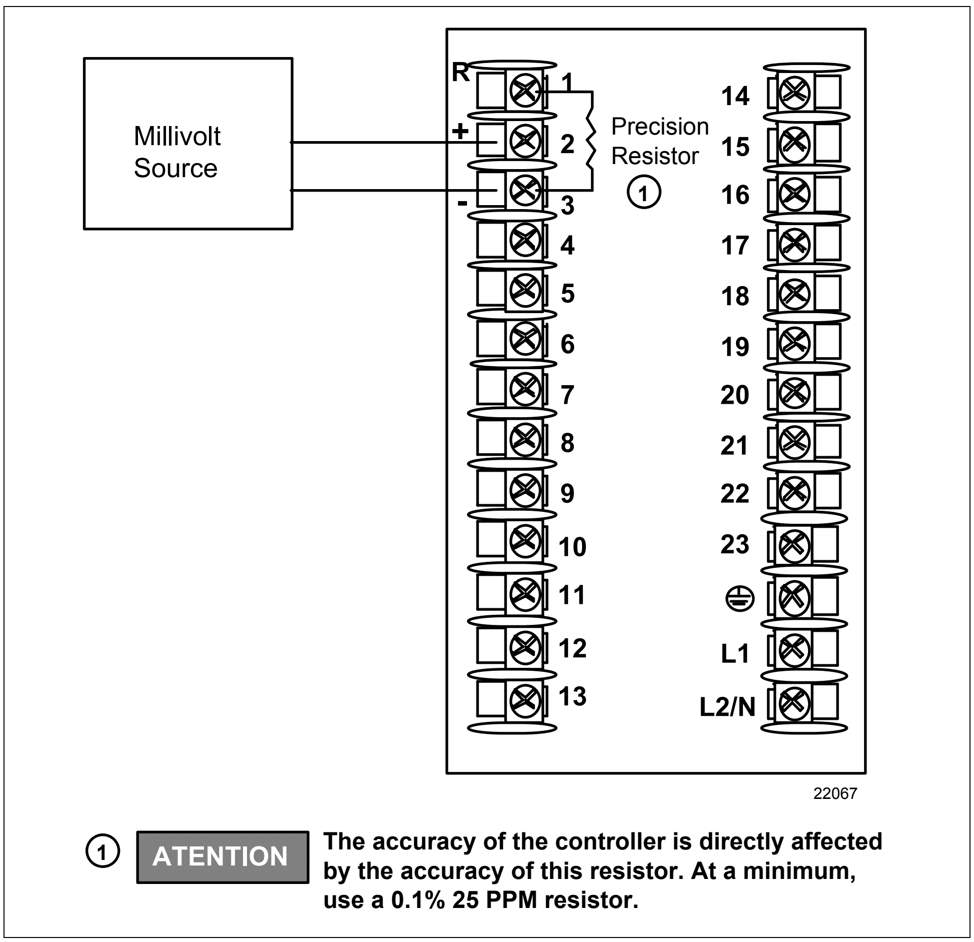
Thermocouple inputs using a precision resistor

Refer to Figure 6-5 and wire the controller according to the procedure given in Table 6-6.

Table 6-6 Set Up Wiring Procedure for Thermocouple Inputs Using a Precision Resistor

Step	Action
1	Connect the copper leads to the calibrator.
2	Disconnect the cold junction resistor.
3	Install a 500 Ohm precision resistor across terminal 1(R) and terminal 3(—). See figure 6-5.
4	Subtract the millivolt value for 77°F (25°C) from the zero and span value for your range (see Table 6-1 for zero and span values) and use the adjusted value when calibrating.

Figure 6-5 Wiring Connections for Thermocouple Inputs Using a Precision Resistor

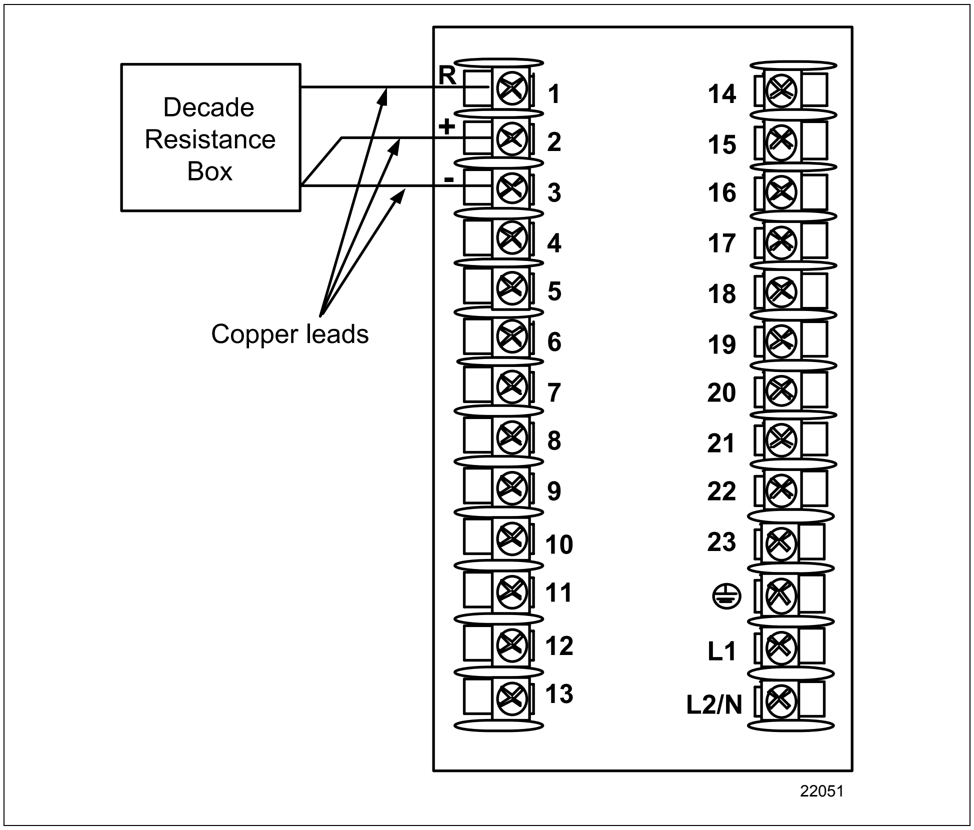


Continued on next page

RTD Inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #5. See Figure 6-6.

Figure 6-6 Wiring Connections for RTD (Resistance Thermometer Device)

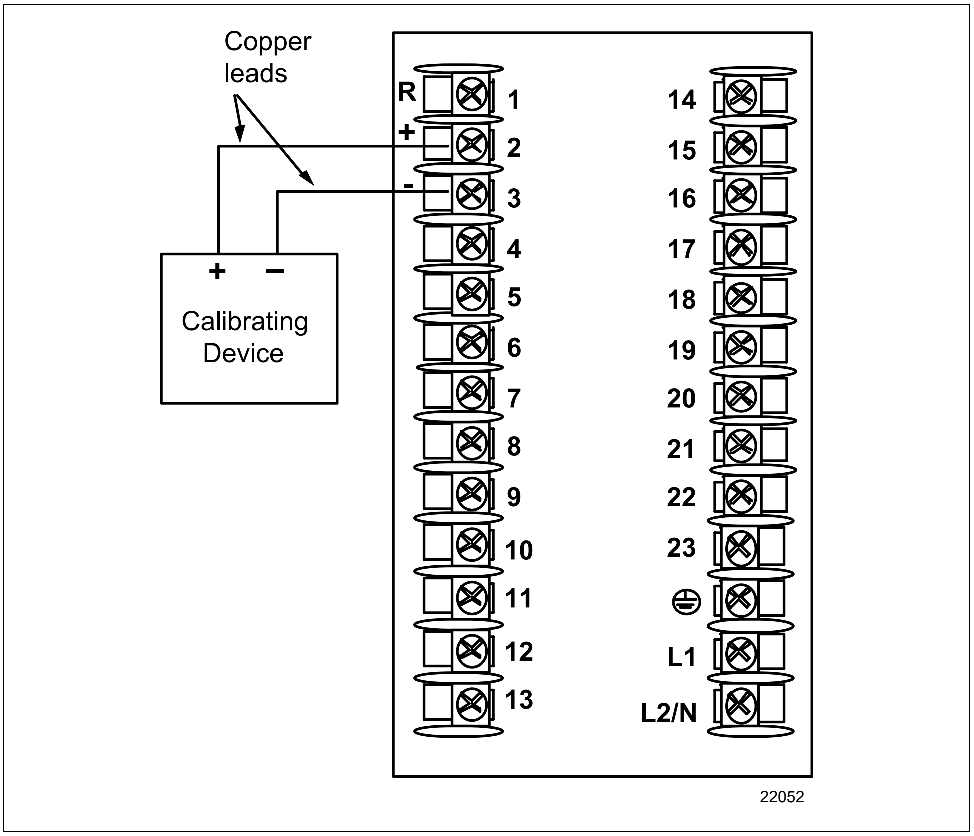


Continued on next page

Radiamatic, Millivolts, Volts, or milliamps Inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #5. See Figure 6-7.

Figure 6-7 Wiring Connections for Radiamatic, Millivolts, Volts, or Milliamps



6.8 Input #5 - Low Level Inputs Calibration Procedure

Introduction

Apply power and allow the controller to warm up for 1 hour before you calibrate.
Please read "*Set Up Wiring*" before beginning the procedure.
Make sure you have "LOCKOUT" set to "NONE." See *Section 3 – Configuration.*

CAUTION For linear inputs, avoid step changes in inputs. Vary smoothly from initial value to final 100% value.

Procedure

The Calibration procedure for Input #5 is listed in Table 6-7.

Table 6-7 Input #5 Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	SET UP until you see	Upper Display: CALIB Lower Display: INPUT 5
		FUNC L1/L2	You will see: Upper Display: DISABL Lower Display: CAL IN5
		▲	The calibration sequence is enabled and you will see: Upper Display: BEGIN Lower Display: CAL IN5 At the completion of the sequence, the selection automatically reverts to disable.
2	Calibrate 0%	FUNC L1/L2	You will see: Upper Display: APPLY Lower Display: IN5 ZERO Adjust your calibration device to an output signal equal to the 0% range value for your particular input sensor. See Table 6-1 for Voltage or Resistance equivalents. Wait 15 seconds, then go to the next step.

Table 6-7 continued on next page

6.8 Input #5 - Low Level Inputs Calibration Procedure,
Continued

Table 6-7 Input #5 Calibration Procedure, continued

<table>
<tr><th>Step</th><th>Description</th><th>Press</th><th>Action</th></tr>
<tr><td>3</td><td>Calibrate 100 %</td><td>FUNC
L1/L2</td><td>You will see:
Upper Display
APPLY

Lower Display
IN5 SPAN

Adjust your calibration device to an output signal equal to the 100% range value for your particular input sensor. See Table 6-1 for Voltage or Resistance equivalents.
Wait 15 seconds, and
<table>
<tr><th>If…</th><th>Then…</th></tr>
<tr><td>you are calibrating a Thermocouple input</td><td>Go to step 4</td></tr>
<tr><td>you are calibrating other than a Thermocouple input</td><td>Go to step 5</td></tr>
</table>
</td></tr>
<tr><td>4</td><td>Check the Cold Junction Temperature

ATTENTION
The accuracy of the controller is directly affected by the accuracy of this value. Change this value only if the zero and span calibration procedures did not bring the controller within the specified accuracy requirements.</td><td>FUNC
L1/L2</td><td>The calculations for zero and span are now stored and you will see:
Upper Display
The cold junction temperature at the rear terminals

Lower Display
C-J TEMP

The value in the upper display is in the tenths of a degree. It is the current reading of the temperature as measured at the thermocouple terminals and recognized by the controller. You can change this value, if it is in error, using the ▲ or ▼ key.

ATTENTION When calibrating T/C inputs using a precision resistor, calibrate the cold junction as 77°F (25°C).</td></tr>
<tr><td>5</td><td>Exit the Calibration Mode</td><td>FUNC
L1/L2</td><td>The controller will store the calibration constants.</td></tr>
<tr><td></td><td></td><td>or

LOWR
DISP</td><td>To exit the calibration mode.

ATTENTION Press the [FUNC/L1-L2] key first to store constants.</td></tr>
</table>

6.9 Input #5 - Pulse Input Preliminary Information

Equipment needed

No equipment is required to do the calibration procedure for Input 5 Pulse Inputs. However, to verify the results, the following will be required:

- Screwdriver
- Frequency Generator with 0.01% accuracy for use as a signal source
- Two insulated copper leads for connecting the calibrator to the controller

Range Specifications

The following are the range specifications for Input 5 Pulse Inputs.

- Frequency Range: 0 – 25000 Hz (Minimum span = 100 Hz)
- Resolution: ± 5 Hz
- High Input Level: +5 to +24 Vdc
- Low Input Level: 0 to 0.5 Vdc

6.10 Input #5 - Pulse Input Calibration Procedure

Procedure Follow the procedure in Table 6-8 to calibrate Input 5 Pulse Inputs.

Table 6-8 Input #5 - Pulse Input Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	SET UP until you see	Upper Display CALIB Lower Display INPUT 5
		FUNC L1/L2	You will see: Upper Display DISABL Lower Display CAL IN5
		▲	The calibration sequence is enabled and you will see: Upper Display BEGIN Lower Display CAL IN5 At the completion of the sequence, the selection automatically reverts to disable.
2	Calibrate Zero	FUNC L1/L2	You will see: Upper Display (Value) Lower Display IN5 ZERO The value displayed represents 1/10 of the actual calibration value. For example: If 500 Hz is the desired zero value, enter 50 for input 5 Zero Value. Minimum Zero Value = 0 Hz
		▲ or ▼	to adjust the zero value then go to the next step.

Table 6-8 continued on next page

Table 6-8 Input #5 Calibration Procedure, continued

Step	Description	Press	Action
3	Calibrate Span	**FUNC L1/L2**	You will see: Upper Display: (Value) Lower Display: IN5 SPAN The value displayed represents 1/10 of the actual calibration value. For example: If 10,000 Hz is the desired span value, enter 1000 for input 5 Span Value. Minimum Span Value = 100 Hz (enter 10) Maximum Span Value = 25,000 Hz (enter 2500)
		▲ or ▼	to adjust the span value
4	Exit Calibration Mode	**FUNC L1/L2** then **LOWR DISP**	to store the calibration constants to exit the calibration mode

6.11 Input #5 - Pulse Input Verification

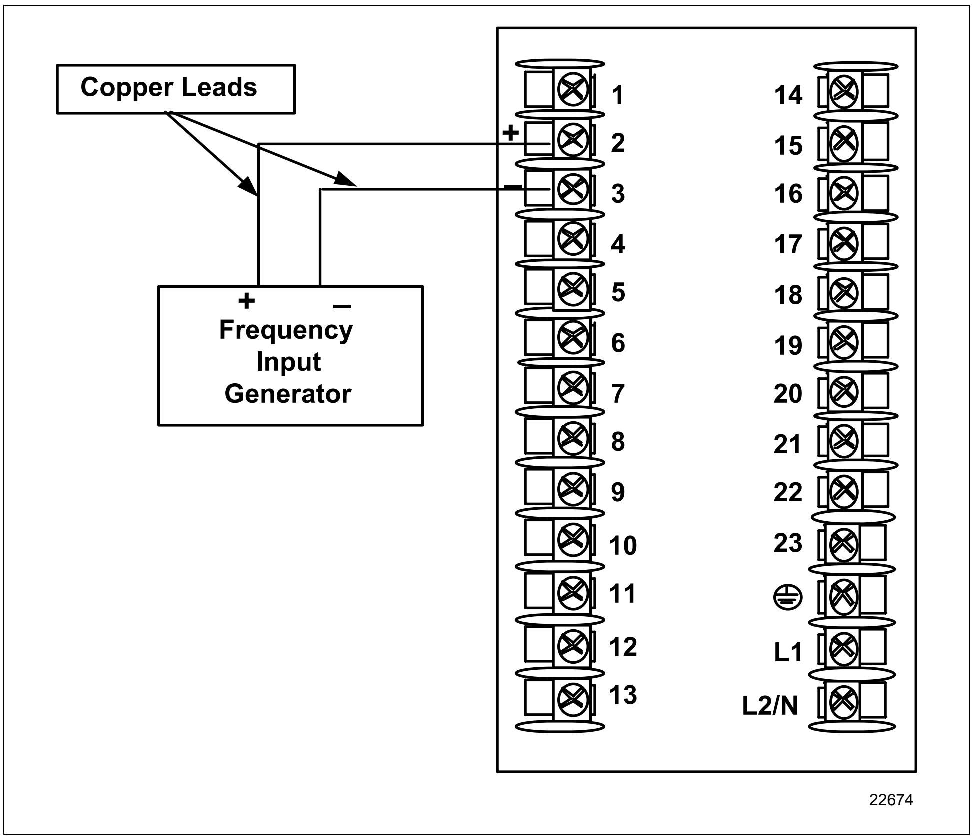
Set up

Refer to Figure 6-8 and wire the controller according to the procedure given in Table 6-9.

Table 6-9 Pulse Input Verification Setup

Step	Action
1	Connect the copper leads from the terminals for Input 5 to the Frequency Input Generator (Terminals 2 and 3).
2	Apply power and allow the controller to warm up for one hour before verification.

Figure 6-8 Test Equipment connections for Calibrating Pulse Inputs



Verification

Enter the desired Zero and Span frequency range from the Input Generator and check to see that the displays read the calibrated Zero and Span values.

6.12 Restoring Factory Calibration

How to restore it

The factory calibration constants for all the input actuation types that can be used with the controller are stored in its nonvolatile memory. Thus, you can quickly restore the "Factory Calibration" for a given input actuation type by simply changing the actuation type to another type and then changing it back to the original type. See Table 6-10 for the procedure.

INPUT 1, 2, 3, or 4
change Function Prompt "XMITTERn" (n=1, 2, 3, or 4)
INPUT 5
change Function Prompt "IN 5 TYPE"

ATTENTION

This procedure applies only for factory-installed inputs. Input 5 that was field-installed must be field calibrated.

Procedure

Table 6-10 lists the procedure for restoring factory calibration.

Table 6-10 Restoring Factory Calibration

Step	Operation	Press	Action/Result
1	Set "LOCKOUT" to "CALIB" or "NONE"	SET UP	Until you see: Upper Display: SET UP Lower Display: TUNING
		FUNC L1/L2	Until you see: Upper Display: One of the following NONE, CALIBRATE, + CONF, + VIEW, MAXIMUM Lower Display: LOCKOUT
		▲ or ▼	Until "CALIBRATE" or "NONE" is in the upper display.
2	For INPUTS 1 THROUGH 4 go to step 3 For INPUT 5 go to step 4		

Table 7-1 is continued on next page

Procedure, continued

Table 6-10 Restoring Factory Calibration, continued

Step	Operation	Press	Action/Result
INPUTS 1, 2, 3, OR 4			
3	Enter "INPUT 1,2,3,4" Setup Group	**SET UP**	Until you see: Upper Display: SET UP Lower Display: INPUTn n = 1, 2, 3, or 4
		FUNC L1/L2	Until you see: Upper Display: ← Current Selection Lower Display: XMITTERn n = 1, 2, 3, or 4
		▲ or ▼	to change the current selection to another selection.
		FUNC L1/L2	Until the lower display rolls through the rest of the functions and returns to Upper Display: ← New Selection Lower Display: XMITTERn n = 1, 2, 3, or 4
		▲ or ▼	Until you change the input selection in the upper display back to the proper selection. You will see: Upper Display: ← Original input selection that matches your type of sensor. Lower Display: XMITTERn n = 1, 2, 3, or 4 GO TO STEP 5.

Continued on next page

Procedure, continued

Table 6-10 Restoring Factory Calibration, continued

Step	Operation	Press	Action/Result
INPUT 5			
4	Enter "INPUT 5" Setup Group	**SET UP**	Until you see: Upper Display: SET UP Lower Display: INPUT 5
		FUNC L1/L2	Until you see: Upper Display: ← Current Selection Lower Display: IN5 TYPE
		▲ or ▼	to change the current selection to another selection.
		FUNC L1/L2	Until the lower display rolls through the rest of the functions and returns to Upper Display: ← Current Selection Lower Display: IN5 TYPE
		▲ or ▼	Until you change the input selection in the upper display back to the proper selection. You will see: Upper Display: ← Original input selection that matches your type of sensor. Lower Display: IN5 TYPE
5	Return to normal operating mode	**LOWR DISP**	To return to Normal operating mode. The factory calibration will be restored. If the problem is not corrected, contact the Honeywell Technical Assistance Center 1-800-423-9883 USA 1-800-461-0013 Canada

Continued on next page

CAUTION

A restored factory calibration overwrites any previous field calibration done for the input and may change the High and Low Range Limits. Be sure to protect any field calibration from accidental overwrites by configuring the appropriate "LOCKOUT" selection after calibration. See the *Section 3 - Configuration* for specific instructions to set the lockout.

Section 7 – Output Calibration

7.1 Overview

Introduction

This section describes the field calibration procedures for the following types of outputs:

- Current Output
- 2nd Current Output
- Three Position Step Control

What's in this section

This section contains the following topics:

Topic		See Page
7.1	Overview	241
7.2	Current Proportional Output Calibration	242
7.3	2nd Current Output Calibration	245

7.2 Current Proportional Output Calibration

Introduction

Calibrate the controller so that the output provides the proper amount of current over the desired range.
The controller can provide an output current range of from 0 to 21 milliamperes and can be calibrated at 4 mA for 0% of output and 20 mA for 100% of output or any other values between 0 and 21 mA.
We recommend that the expected output load be connected for optimum accuracy.

Equipment needed

You will need a standard shop type milliammeter, with whatever accuracy is required, capable of measuring 0 to 20 milliamps.

Calibrator connections

Refer to Figure 7-1 and wire the controller according to the procedure given in Table 7-1.

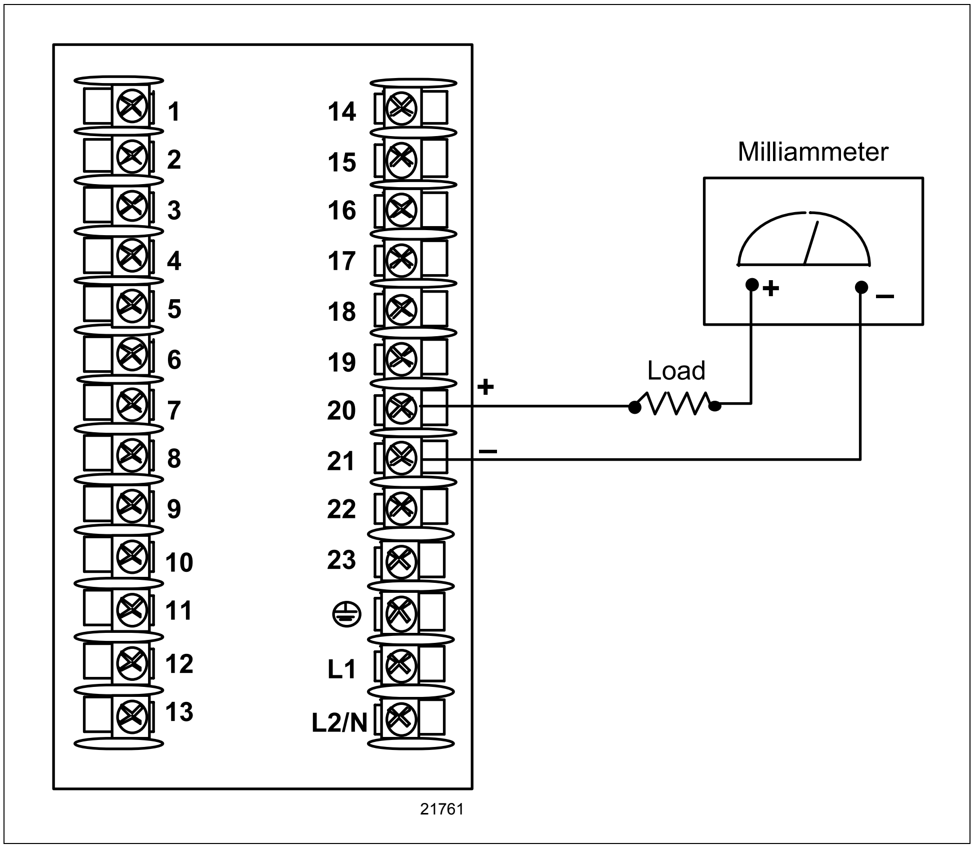
Table 7-1 Set Up Wiring Procedure Current Proportional Output

Step	Action
1	Tag and disconnect the field wiring, at the rear of the controller, from terminals 20(+) and 21(–). See Figure 7-1.
2	Connect a Milliammeter across these terminals.
3	Connect a load resistor, equivalent to the process load, in series with the milliammeter. See Figure 7-1.
4	Apply power and allow the controller to warm up 15 minutes before you calibrate.

Continued on next page

Calibrator connections, continued

Figure 7-1 Wiring Connections for Calibrating Current Proportional Output



Continued on next page

Procedure

The procedure for calibrating the Current Proportional Output is listed in Table 7-2. Make sure "LOCKOUT" in the Tuning Set Up group is set to "NONE." See *Section 3 – Configuration.*

Table 7-2 Current Proportional Output Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	**SET UP** until you see	Upper Display: CALIB Lower Display: CURRENT
2	Calibrate 0%	**FUNC L1/L2**	You will see: Upper Display: **(Value)** Lower Display: ZERO VAL
		▲ or ▼	until the desired 0% output (normally 4mA) is read on the milliammeter. Use the values shown below depending on the action of your controller. *When attempting to achieve 0 mA, always adjust the output to about 0.5 mA, and slowly decrease until the output just goes to zero. Further decrementing will not change the output current (since the circuit cannot produce negative current) but will affect the accuracy of the output by creating a dead zone where no current flows.
3	Calibrate 100%	**FUNC L1/L2**	This stores the 0%value and, You will see: Upper Display: **(Value)** Lower Display: SPAN VAL
		▲ or ▼	until the desired 100% output (normally 20mA) is read on the milliammeter. Use the values shown below depending on the action of your controller.
4	Exit the Calibration Mode	**FUNC L1/L2**	The controller will store the span value.
		or **LOWR DISP**	To exit the calibration mode. **ATTENTION** Press the [FUNC/L1-L2] key first to store constants.

7.3 2nd Current Output

Introduction

Calibrate the controller so that the Second Current Output provides the proper amount of current over the desired range.
The controller can provide a 2nd Output current range of from 0 to 21 milliamperes and can be calibrated at 4 mA for 0% of output and 20 mA for 100% of output or any other values between 0 and 21 mA.

Equipment needed

You will need a standard shop type milliammeter with whatever accuracy is required, capable of measuring 0 to 20 milliamps.

Calibrator connections

Refer to Figure 7-2 and wire the controller according to the procedure given in Table 7-3.

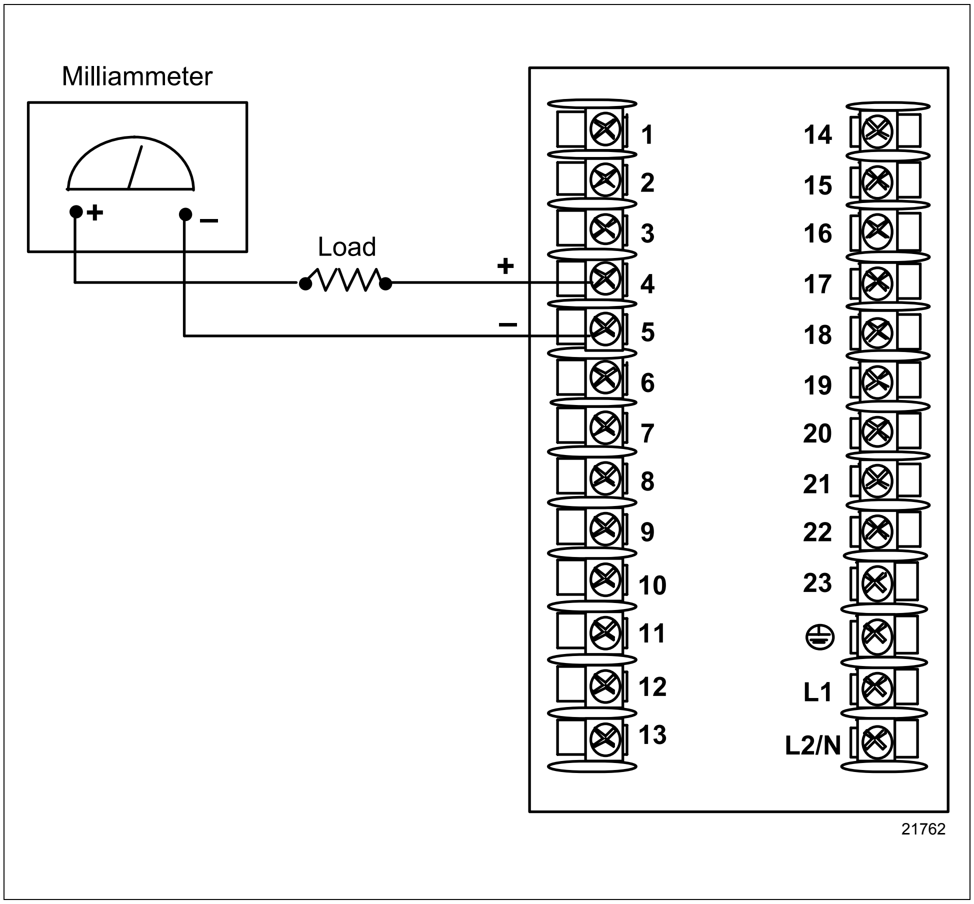
Table 7-3 Set Up Wiring Procedure for 2nd Current Output

Step	Action
1	Tag and disconnect the field wiring, at the rear of the controller, from terminals 4(+) and 5(–). See Figure 7-2.
2	Connect a Milliammeter across these terminals.
3	Apply power and allow the controller to warm up 15 minutes before you calibrate.

Continued on next page

Calibrator connections, continued

Figure 7-2 Wiring Connections for Calibrating 2nd Current Output



Continued on next page

Procedure

The procedure for calibrating the 2nd Current Output is listed in Table 7-5. Make sure "LOCKOUT" in the Tuning Set Up group is set to "NONE." See *Section 3 – Configuration.*

Table 7-4 2nd Current Output Calibration Procedure

Step	Description	Press	Action
1	Enter Calibration Mode	**SET UP** until you see	Upper Display: CALIB Lower Display: CUR OUT2
2	Calibrate 0%	**FUNC L1/L2**	You will see: Upper Display: (a value) Lower Display: ZERO VALU
		▲ or ▼	until the desired 0% output (normally 4mA) is read on the milliammeter. Use the values shown below depending on the action of your controller. *When attempting to achieve 0 mA, always adjust the output to about 0.5 mA, and slowly decrease until the output just goes to zero. Further decrementing will not change the output current (since the circuit cannot produce negative current) but will affect the accuracy of the output by creating a dead zone where no current flows.
3	Calibrate 100%	**FUNC L1/L2**	This stores the 0%value and, you will see: Upper Display: (value) Lower Display: ZERO VALU
		▲ or ▼	until the desired 100% output (normally 20mA) is read on the milliammeter. Use the values shown below depending on the action of your controller.
4	Exit the Calibration Mode	**FUNC L1/L2**	The controller will store the span value.
		or **LOWR DISP**	To exit the calibration mode. **ATTENTION** Press the [FUNC/L1-L2] key first to store value.

Section 8 – Troubleshooting / Service

8.1 Overview

Introduction

Instrument performance can be adversely affected by installation and application problems as well as hardware problems. We recommend that you investigate the problems in the following order;

- Installation related problems
- Application related problems
- Hardware and software related problems

and use the information presented in this section to solve them.
If a replacement of any part is required, follow the procedures listed under "Parts Replacement Procedures".

What's in this section?

The following topics are covered in this section.

Topic		See Page
8.1	Overview	249
8.2	Troubleshooting Aids	251
8.3	Power-up Tests	253
8.4	Status Tests	254
8.5	Background Tests	257
8.6	Controller Failure Symptoms	259
8.7	Troubleshooting Procedures	260
8.8	Parts Replacement Procedures	266
8.9	Maintenance	277

WARNING—SHOCK HAZARD

TROUBLESHOOTING MAY REQUIRE ACCESS TO HAZARDOUS LIVE CIRCUITS, AND SHOULD ONLY BE PERFORMED BY QUALIFIED SERVICE PERSONNEL. MORE THAN ONE SWITCH MAY BE REQUIRED TO DE-ENERGIZE UNIT BEFORE SERVICING.

Continued on next page

Installation related problems

Read the Installation section in this manual to make sure the UDC6300 has been properly installed. The installation section provides information on protection against electrical noise, connecting external equipment to the controller, and shielding and routing external wiring.

ATTENTION System noise induced into the controller will result in diagnostic error messages recurring. If the diagnostic error messages can be cleared, it indicates a “soft” failure and is probably noise related.
If system noise is suspected, completely isolate the controller from all field wiring. Use calibration sources to simulate PV and check all controller functions; i.e. Gain, Rate, Reset, Output, Alarms, etc.

Application related problems

Review the application of the controller; then, if necessary, direct your questions to the local sales office.

Hardware and software related problems

Use the troubleshooting error message prompts and controller failure symptoms to identify typical failures which may occur in the controller. Follow the troubleshooting procedures to correct them.

8.2 Troubleshooting Aids

Overall error messages

An error message can occur
- at power-up
- during continuous background tests while in normal operation
- when the Status Tests are requested

Table 8-1 lists all the error message prompts that you could see, the reason for the failure, and under what test group the prompt could appear. Refer to Tables 8-3 (Power-up), 8-5 (Status), and 8-6 (Background) for the particular test group indicated.

Table 8-1 Error Message Prompts

Error Message (lower display)	Reason for Failure	Test Group	Refer to Table
CAL TEST	Calibration test failure	Power-up or Status	8-3 8-5
CONF ERR	Low limit > than high limit for PV, SP, Reset, or Output	Background	8-6
CONFTEST	Configuration data in controller in error	Power-up or Status	8-3 8-5
DO FAILED	Digital Output 1 through 4 in error	Background	8-6
E E FAIL	Unable to write to non-volatile memory	Background	8-6
FACT CRC	Factory Calibration Cyclic Redundancy test	Status	8-5
FAILSAFE	Controller in Failsafe	Power-up, Background, or Status	8-3 8-5 8-6
IN1 FAIL **IN2 FAIL** **IN3 FAIL** **IN4 FAIL**	Two consecutive failures of Input integration	Background	8-6
IN5 FAIL	Two consecutive failures of Input 5 integration	Background	8-6
IN1 RNG **IN2 RNG** **IN3 RNG** **IN4 RNG** **IN5 RNG**	Input Out of Range	Background	8-6
LOOPBACK	DMCS Loopback Test	Status	8-5
PV RANGE	Derived PV Out of Range	Background	8-6
RAM TEST	RAM test failed	Power up or Status	8-3 8-5
RV RANGE	Remote Input Out of Range	Background	8-6
VERSION	Software Version	Status	8-5

Continued on next page

8.2 Troubleshooting Aids, Continued

Controller failure symptoms

Other failures may occur that deal with the Power, Output, or Alarms. Refer to the controller failure symptom in Table 8-7 to determine what is wrong and the troubleshooting procedures to use to correct the problem.

Check Installation

If a set of symptoms still persists, refer to *Section 2 - Installation* and ensure proper installation and proper use of the controller in the system.

Customer support

If you cannot solve the problem using the troubleshooting procedures listed in this section; get the **model number** and **serial number** from the label on the chassis molding, and **software** version (see Table 8-2) then:

call Customer Support Phone Number
1-800-423-9883 USA
1-800-461-0013 Canada.

If it is determined that a hardware problem exists and the controller is still within the two year warranty, a replacement controller will be shipped with instructions for returning the defective unit.

Determining the software version

Table 8-2 lists the procedure for identifying the software version number.

Table 8-2 Procedure for Identifying the Software Version

Step	Operation	Press	Action
1	Select STATUS Set Up Group	**SET UP**	Until you see: Upper Display READ Lower Display STATUS
2	Read the software version	**FUNC L1/L2**	Until you see: Upper Display Software version Number Lower Display VERSION Please give this number to the Customer Support person. It will indicate which version of UDC 6300 you have and help them determine a solution to your problem.

8.3 Power-up Tests

What happens at power-up

When the controller is powered-up, three tests are run by the UDC6300 software to ensure memory integrity.

As the tests are run, the displays will appear as shown in Table 8-3.

Table 8-3 Power-up Tests

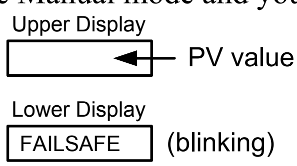
Lower Display	Upper Display
RAM TEST	PASS or FAIL
CONFTEST	PASS or FAIL
CAL TEST	PASS or FAIL

After these tests, every segment in the display is turned on for 5 seconds, and then "TEST DONE" is shown in the Lower Didplay.

The controller then checks the non-volatile memory, displaying 'CHECKING MEMORY" in the Lower Display.

Test failures

If any of these tests fail, "FAIL" will appear momentarily in the upper display, then a display test is run, after which the controller will go into Failsafe Manual mode and you will see:



Refer to "*Status Tests*" to determine which tests have failed and how to correct them.

8.4 Status Tests

Introduction

When required, the results of these tests can be checked to determine the reason the controller has gone to “Failsafe”.

How to check the status tests

The procedure in Table 8-4 tells you how to display the results of the status tests. Table 8-5 lists the tests, the reason for the failure, and how to correct the problem.

Table 8-4 Procedure for Displaying the Status Tests Results

Step	Operation	Press	Action
1	Select STATUS Set Up Group	**SET UP**	Until you see: Upper Display READ Lower Display STATUS
2	Read the status tests results	**FUNC L1/L2**	Until you see: Upper Display NO or YES — YES indicates a failure Lower Display FAILSAFE Successive presses of the FUNC key will display the results of the status tests in the following order: RAM TEST CONF TEST CAL TEST FACT CRC LOOPBACK Identify the problem and correct the failure as shown in Table 8-5.

Continued on next page

Status Tests Table 8-5 lists the Status tests, the reason for their failure, and how to correct the failure.

Table 8-5 Status Tests

Test (Lower Display)	**Definition**	**Upper Display**	**Reason for Failure**	**How to Correct the Failure**
FAILSAFE **FAILSF 2 (Loop 2)**	Failsafe Fault	NO	No Failure	
		YES	Burnout configured for none and input fails. –RAM TEST failed –CONFTEST failed –CALTEST failed	1. Step through the rest of the STATUS check to identify the particular failure. Press [FUNC] key and then step through all the status prompts a second time to verify if the particular failed code has cleared and shows "Passed". Also see Table 8-6, Background tests.
RAM TEST	RAM test	PASS	No Failure	RAM test passed.
		FAIL	RAM Failure	1. Power cycle to see if the error clears.
CONF TEST	Configuration Checksum	PASS	No Failure	Configuration checksum passed.
		FAIL	Configuration data in the controller is in error.	1. Step through STATUS tests – the controller will recalculate the checksum. 2. Check all configuration prompts for accuracy. See *Section 3 - Configuration*
CAL TEST	Working Calibration	PASS	No Failure	Working calibration checksum passed.
		FAIL	The working calibration constants in the controller are in error.	1. If the controller has not been field calibrated, see *Section 3 - Configuration* and change the input to a different type. Enter it, loop through the status tests, then return the input type to the original one. 2. If the controller has been field calibrated, recalibrate the controller.

Table 8-5 continued on next page

Status Test, continued

Table 8-5 Status Tests, continued

Test (Lower Display)	Definition	Upper Display	Reason for Failure	How to Correct the Failure
FACT CRC	Factory calibration test	PASS	No Failure	Factory calibration cyclic redundancy test passed
		FAIL	Factory set input constants have been changed due to the change in input type.	1. Cycle through Status to clear the error. 2. Check the calibration. Make sure 0 and 100% are correct values. 3. Recalibrate if step 1 is unsatisfactory. Refer to *Section 6 - Input Calibration*.
LOOPTEST	DMCS Loopback Test	PASS	No Failure	Loopback Test passed.
		FAIL	Unable to communicate with the controller through DMCS	1. Check to see if the DMCS board is installed properly. 2. Check the rear terminal wiring. See *Section 2 - Installation* for terminal designations.

8.5 Background Tests

Introduction

The UDC6300 performs on-going background tests to verify data and memory integrity. If there is a malfunction, an error message will be displayed (blinking) in the lower display.

Background Tests

In the case of more than one simultaneous malfunction, only the one with the highest priority will appear in the lower display. Table 8-6 lists these background tests, the reason for their failure, and how to correct the problem.

Table 8-6 Background Tests

Lower Display	Reason for Failure	How to Correct the Problem
EE FAIL	Unable to write to non-volatile memory. Anytime you change a parameter and it is not accepted, you will see EE FAIL.	1. Check the accuracy of the parameter and re-enter. 2. Try to change something in configuration. 3. Run through STATUS tests to re-write to EEPROM.
FAILSAFE	This error message shows whenever the controller goes into a failsafe mode of operation. This will happen if: • RAM test failed • Configuration test failed • Calibration test failed • EEPROM test failed • Any input used for PV or RSP has failed.	1. Run through STATUS check to determine the reason for the failure. 2. Press the SET UP key until STATUS appears in the lower display. 3. Press the FUNC key to see what tests pass or fail, then run through the STATUS codes a second time to see if the error cleared. 4. Correct according to the recommendations given in Table 8-5.
IN1 FAIL **IN2 FAIL** **IN3 FAIL** **IN4 FAIL**	Failure of input integration. i.e., cannot make analog to digital conversion.	1. Make sure the input configuration and wiring is correct. 2. Make sure the correct resistor is attached to the rear terminals for the particular range required. 3. Check for gross over-ranging.
IN5 FAIL	Failure of input 5 integration. i.e., cannot make analog to digital conversion.	1. Make sure the actuation is configured correctly. See *Section 3 - Configuration.* 2. Make sure the input configuration and wiring is correct. 3. Make sure the Cold Junction is connected to the Thermocouple ranges. 4. Check for gross over-ranging. 5. Replace the Cold Junction Resistor.
CONF ERR	• PV low limit is > PV high limit • SP low limit is > SP high limit • Reset low limit is > Reset high limit • Output low limit > Output high limit	1. Check the configuration for each item and reconfigure if necessary.

Table 8-6 continued on next page

Table 8-6 Background Tests, continued

Lower Display	Reason for Failure	How to Correct the Problem
IN1 RANGE **IN2 RANGE** **IN3 RANGE** **IN4 RANGE** **IN5 RANGE**	*Input out of range*. The process input is outside the range limits. *Input 5 Pulse Input* - Pulse Input less than zero value or greater than span value. **ATTENTION** If the range goes outside the range limits, the controller will switch to Manual and the configured Failsafe output value.	1. Make sure the range and actuation are configured properly. 2. Check the input source. 3. If the controller has not been field calibrated, see *Section 3 - Configuration* and change the input to a different type. Enter it, loop through the status tests, then return the input type to the original one. 4. If the controller has been field calibrated, recalibrate the controller.
PV RANGE	A. PV out of range. B. Loop Input algorithm exceeds the PV limit	A1. Make sure the input signal is correct. A2. Make sure the Bias setting is correct. A3. Recheck the calibration. Use Bias of 0.0. B1. Reconfigure the Input algorithm.
RV RANGE	RV out-of-range	1. Make sure the input signal is correct. 2. Make sure the Ratio and Bias settings are correct. 3. Recheck the calibration. Use a Ratio of 1.0 and a Bias of 0.0.
DO FAILED	The read state of Digital Output 1 through 4 does not compare with the correct state.	1. Make sure the connections are correct. 2. Check if the connections are shorted. 3. Does the load exceed 300mA? 4. Is there a closed Digital Input switch connected to an active Digital Output?

8.6 Controller Failure Symptoms

Introduction

In addition to the error message prompts, there are failure symptoms that can be identified by noting how the controller displays and indicators are reacting.

Symptoms

Compare your symptoms with those shown in Table 8-7 and refer to the troubleshooting procedure indicated to correct the problem.

Table 8-7 Controller Failure Symptoms

<table>
<tr><th>Upper Display</th><th>Lower Display</th><th>Indicators</th><th>Controller Output</th><th>Probable Cause</th><th>Trouble-shooting Procedure</th></tr>
<tr><td>Blank</td><td>Blank</td><td>Off</td><td>None</td><td>Power Failure</td><td>1</td></tr>
<tr><td>OK</td><td rowspan="2">Displayed Output disagrees with Controller Output</td><td>OK</td><td rowspan="2">Controller Output disagrees with Displayed Output</td><td>Current Proportional Output</td><td>2</td></tr>
<tr><td>OK</td><td>OK</td><td>Time Proportional (Digital) Output</td><td>3</td></tr>
<tr><td>OK</td><td>OK</td><td>OK</td><td>External Alarm function does not operate properly</td><td>Malfunction in alarm output</td><td>4</td></tr>
<tr><td colspan="4">Display does not function when a key is pressed</td><td>Keyboard Malfunction</td><td>5</td></tr>
<tr><td colspan="4">Controller fails to go into “Slave” operation during communications</td><td>Communications Failure</td><td>6</td></tr>
</table>

Other symptoms

If a set of symptoms or prompts other than the one you started with appears while troubleshooting, re-evaluate the symptoms. This may lead to a different troubleshooting procedure.
If the symptom still persists, refer to the installation section in this manual to ensure proper installation and proper use of the controller in your system.

8.7 Troubleshooting Procedures

Introduction

The troubleshooting procedures are listed in numerical order as they appear in Table 8-7. Each procedure lists what to do if you have that particular failure and how to do it or where to find the data needed to accomplish the task.

Equipment needed

You will need the following equipment in order to troubleshoot the symptoms listed in the tables that follow:

- DC Milliammeter – mAdc
- Calibration sources – T/C, mV, Volt, etc.
- Voltmeter

Procedure #1

Table 8-8 explains how to troubleshoot power failure symptoms.

Table 8-8 Troubleshooting Power Failure Symptoms

Step	What to do	How to do it
1	Check the AC line voltage.	Use a Voltmeter to measure the AC voltage across terminals L1 and L2 on the rear terminal panel of the controller. Check the earth ground connection.
2	Make sure the chassis plugs into the rear of the case properly.	Withdraw the chassis and visually inspect the controller board and the inside of the case.
3	Check the Voltage selection. Make sure the correct fuse is in the proper location.	See if the Power Select Jumper on the controller printed wiring board is in the proper position for the Voltage being used. Make sure the correct fuse is installed. See "Installing the Fuse, Label, and Power Select Jumpers" in *Section 2 - Installation*.
4	Check the system for Brown-outs, heavy load switching, etc.; and conformance to installation instructions.	Refer to *Section 2 - Installation*.

Continued on next page

Procedure #2

Table 8-9 explains how to troubleshoot Current Proportional Output failure symptoms.

Table 8-9 Troubleshooting Current Proportional Output Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Current output.	Make Set Up group prompt “OUT ALG”. Function prompt “OUT ALG” = selection “CURRENT” or "OUT2 ALG = selection "CURRENT". Refer to *Section 3 - Configuration*.
2	Check the field wiring.	Output impedance must be less than or equal to 1000 Ohms.
3	Make sure all the configurable tuning constants, limits, and configuration data stored in the controller are correct. Reconfigure, if necessary.	Refer to *Section 3 - Configuration* to check all this data and how to reconfigure.
4	Check the output.	Press the LOWR DISP key until you see OUT in the Lower Display. Change the output from 0 to 100% (4-20 mA). Use a DC milliammeter at the rear terminals 20 and 21 for current output #1 or terminals 4 and 5 for the second current output to verify the output.
5	Recalibrate the Current Proportional Output.	Refer to *Section 7 - Output Calibration* for details.

Continued on next page

Procedure #3

Table 8-10 explains how to troubleshoot Time Proportional Digital Output(s) failure.

Table 8-10 Troubleshooting Time Proportional Digital Output(s) Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Time Proportional Digital output(s).	Make Set Up group prompt "OUT ALG". Function prompt "OUT ALG" = selection is "TIME" (Digital Output 3) "TIME DPLX" (Digital Output 3 & 4) "CUR TIME" (Digital Output 3 = Heat) "TIME CUR" (Digital Output 3 = Cool) whichever is required. Refer to *Section 3 - Configuration*.
2	Check the field wiring.	See *Section 2 - Installation* for wiring diagrams. • Check the power supply connections at terminals 6 &7. • Check Digital Outputs 3 & 4 connections at terminal 6 & 12 or 6 & 13. • Make sure that any external mechanical or Solid State relays are receiving the signal.
3	Make sure all the configurable tuning constants, limits, and configuration data stored in the controller are correct. Reconfigure, if necessary.	Refer to *Section 3- Configuration* to check all this data and how to reconfigure.
4	Check that the Digital Output actuates properly per the controller output value.	• Check the Digital Output continuity at rear terminals 6 & 12 (Digital Output 3) and 6 & 13 (Digital Output 4) • Place the controller in Manual mode and verify that continuity is correct when the Output is at 100% and when the Output is 0%.

Continued on next page

Procedure #4

Table 8-11 explains how to troubleshoot Alarm Digital Output(s) failure.

Table 8-11 Troubleshooting Alarm Digital Output(s) Failure

Step	What to do	How to do it
1	Check the alarm configuration data. If it is correct, check the field wiring.	Reconfigure if necessary. Refer to *Section 3 - Configuration* for details.
2	Check that the applicable Digital Output energizes per error signal properly. It depends on what you have set at "ALARMS" group prompt "AxSxTYPE". If it does, check the field wiring.	If the alarm type is set for PV, place the controller in manual mode. Vary the input to raise and lower the PV around the setpoint. Note that the bargraphs and proper annunciators flash. If the alarm is set for OUTPUT, put the controller into manual mode. Raise or lower the output above or below the value you have set as the alarm setpoint. Note that the bargraphs and proper annunciators flash. Check for proper continuity when the alarm actuates.
3	Check the field wiring for Digital Outputs 1, 2, 3, 4.	Refer to *Section 2 - Installation* for details. • Check the power supply connection at the rear terminals 6 and 7. • Check the Digital Output connections at the following terminals: 6, 10 D/O#1 6, 11 D/O#2 6, 12 D/O#3 6, 12 D/O#4 Check for proper continuity. • Make sure that any external mechanical or solid state relays are receiving the Digital Output signals.

Continued on next page

Procedure #5

Table 8-12 explains how to troubleshoot a Keyboard failure.

Table 8-12 Troubleshooting a Keyboard Failure

Step	What to do	How to do it
1	Make sure the keyboard is connected properly to the Display board.	Withdraw the chassis from the case and visually inspect the connection.
2	Controller Keyboard may be "LOCKED OUT" via the security code.	Use your 4 digit security code number to change the lockout level. Refer to *Section 3 – Configuration.* **ATTENTION** Using "1000" as a security code number will override the 4-digit code previously entered.
3	Run the keyboard test.	Press the SET UP key and hold in, then press the FUNC key at the same time. The controller will run a display test. Then you will see: Upper Display KEYS Lower Display (Key Name) Press each key. If it works, the key name will appear in the lower display.
4	Replace the keyboard if any keys are shorted out.	Refer to *"Parts Replacement Procedures*" in this section.

Continued on next page

Procedure #6

Table 8-13 explains how to troubleshoot a DMCS Communications failure.

Table 8-13 Troubleshooting a DMCS Communications Failure

Step	What to do	How to do it
1	Check the field wiring and termination resistor.	Depending on the protocol used, refer to the proper communications Manual Installation Section.
2	Make sure the DMCS Communications Printed Wiring Board is installed properly in the controller.	Withdraw the chassis from the case and inspect the board. See the exploded view (Figure 9-1) for location of the board. Return the chassis to the case.
3	Determine if the DMCS Communications board is faulty by running a LOCAL LOOPBACK TEST. If the test fails, replace the board.	Run the Local Loopback Test. Press [SET UP] until you see: Upper Display: SET UP Lower Display: COM Press [FUNC] until you see: Upper Display: DISABL Lower Display: LOOPBACK Press ▲ or ▼, you will see: Upper Display: ENABLE Lower Display: LOOPBACK **ATTENTION** The test will run until the operator disables it here.

8.8 Parts Replacement Procedures

Introduction

These procedures tell you how to access and replace the following printed wiring boards in your controller.

- Bezel/Keyboard and/or Display Board
- MCU/Inputs Board
- Communications Option Board
- Power / DIO Board
- Input 5 - Low Level or Pulse Input Board

Figure 8-1 shows you how to remove the chassis from the case.

Figure 8-2 identifies all the printed wiring boards and parts necessary to facilitate removing and replacing the parts listed above.

Figure 8-3 Identifies the accessed printed wiring boards.

Controller replacement

ATTENTION If you are replacing a UDC6000 or an existing UDC6300 you can keep the old configuration data by removing the EEPROM from the old unit and placing it in the new unit. Refer to Figure 8-2 for location of the UDC6300 EEPROM and the following instructions:

• *Replacing a **UDC6000** with a **UDC6300***
remove the UDC6300 EEPROM at U106 and replace it with the UDC6000 EEPROM at U26. This IC contains all the configuration data that was in the UDC6000, so, the UDC6300 will now have the same configuration as the UDC6000 that you are replacing.

• *Replacing a **UDC6300** with a*
remove the EEPROM at U106 from the new UDC6300 and replace it with the EEPROM from the old UDC6300. The new UDC6300 will now have the same configuration as the one that you are replacing.

Equipment needed

To accomplish the procedures that follow, you will need the following equipment:

- Phillips Head Screwdriver
- Flat Bladed Screwdriver
- Small Pliers

Continued on next page

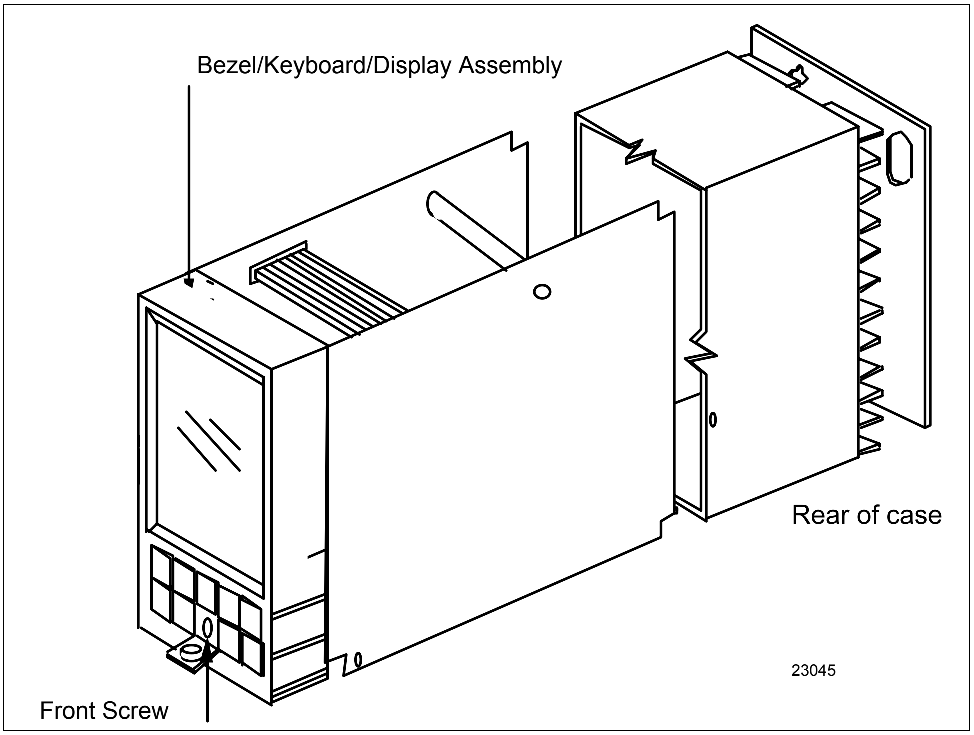
How to remove the chassis

Refer to Figure 8-1 for steps and follow the procedure listed in Table 8-14.

Table 8-14 How to Remove the Chassis

Step	Action
1	Pull down the flap covering the front screw and loosen the screw.
2	Grasp the bezel and pull the chassis out of the case.

Figure 8-1 Chassis Removal

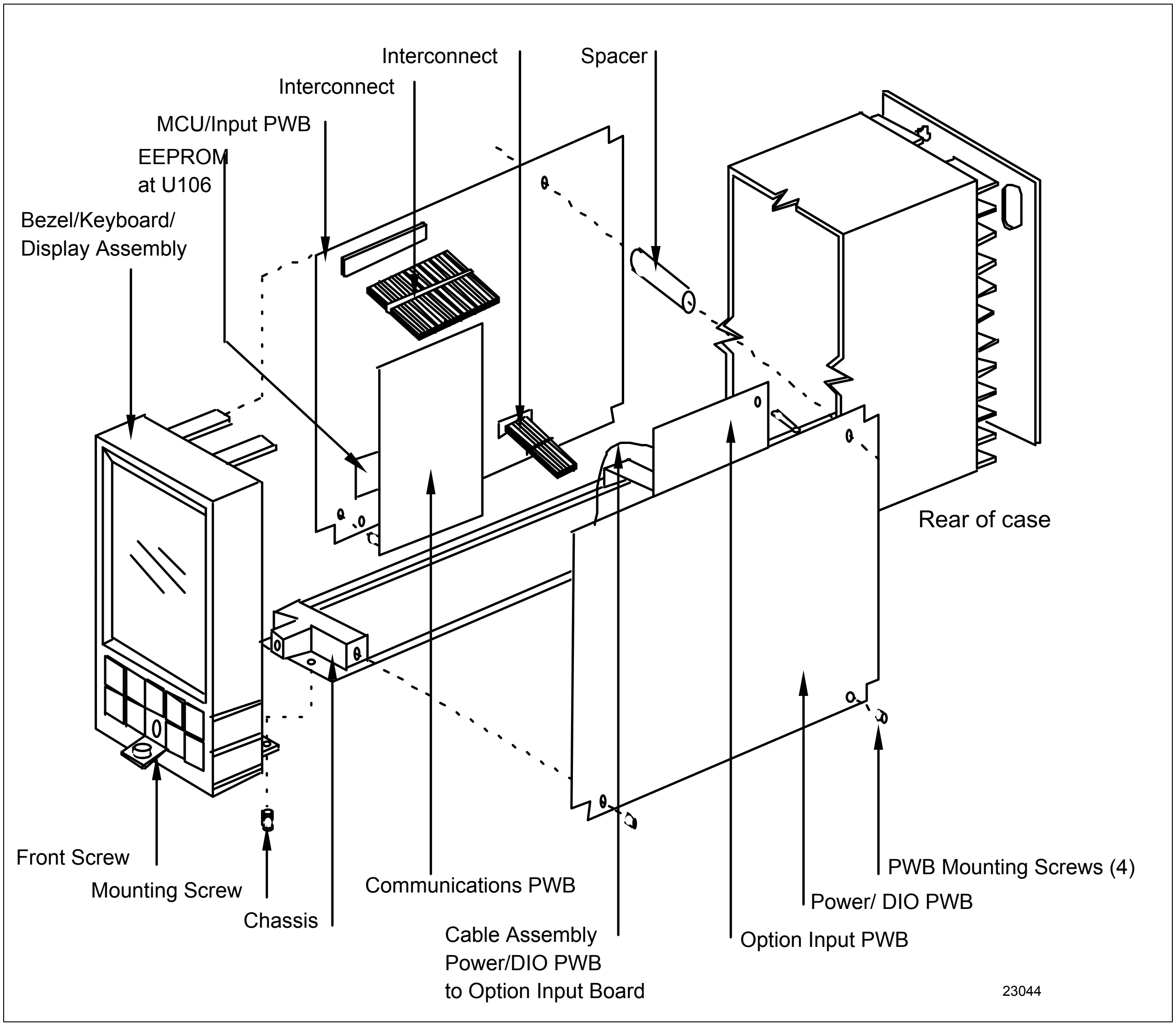


Continued on next page

Parts Identification

Figure 8-2 identifies all the Printed Wiring Boards and parts necessary to facilitate removing and replacing the parts listed.

Figure 8-2 Replacement Parts Identification



Continued on next page

How to replace Bezel/ Keyboard/Display assembly, Keyboard assembly, or Display PWB

To replace the

- Bezel/Keyboard/Display assembly - *Procedure A*
- Keyboard assembly - *Procedure B*
- Display printed wiring board *Procedure C* ,

refer to Figure 8-2 for parts location, remove the chassis from the case (see Figure 8-1), and follow the procedures in Table 8-15.

Table 8-15 Bezel/Keyboard/Display Assembly Replacement Procedure

Step	Action
PROCEDURE A - Bezel/Keyboard/Display assembly (Part Number 30757007-501)	
1A	Remove the two screws on the bottom of the chassis frame that hold the bezel/Keyboard/Display assembly in place on the chassis frame (refer to Figure 8-2 for location of the screws).
2A	Lift the two retainers (see Figure 8-3, next page) slightly away from the printed wiring boards notch and the bracket on the other side and pull the printed wiring boards and chassis out of plug P9 on the back of the display board. The Bezel/Keyboard/Display board will come away in one piece.
PROCEDURE B - Keyboard assembly (Part Number 30757071-501)	
1B	Do steps 1A and 2A.
2B	Peel off the rubber bezel and glass and pull off the front of the plastic bezel and see Figure 8-4 next page.
3B	Insert a small flat-bladed screwdriver into each side of the keyboard and gently pry up. The keyboard will unplug from the display board.
4B	Replace the keyboard. Position the plug on the keyboard into the connector on the display board and snap the keyboard into place. Make sure it is seated properly.
5B	Reassemble the bezel and reattach it to the chassis frame.
PROCEDURE C - Display Printed Wiring board (Part Number 30757010-501)	
1C	Do steps 1B through 3B.
2C	Place a thumb on either side of the plastic bezel (see Figure 8-4, next page). With your fingers on the back of the display board, separate the sides of the bezel with your thumbs and use your fingers to push the top of the display board out through the front of the bezel.
3C	Lift the display board up and out of the bezel frame.
4C	Insert the new display board down into the bezel frame. **BE CAREFUL THAT THE EVACUATION TUBE DOES NOT HIT THE BEZEL FRAME.**
5C	Snap the display board into place in the bezel frame.
6C	Replace the keyboard. Make sure it is seated properly.
7C	Replace the rubber bezel assembly.
8C	Attach the Bezel to the chassis with the two screws removed.

How to replace Bezel/ Keyboard/Display assembly, Keyboard assembly, or Display PWB, continued

Figure 8-3 shows the location of the retainers on the controller board.

Figure 8-3 Bezel/Keyboard/Display Assembly

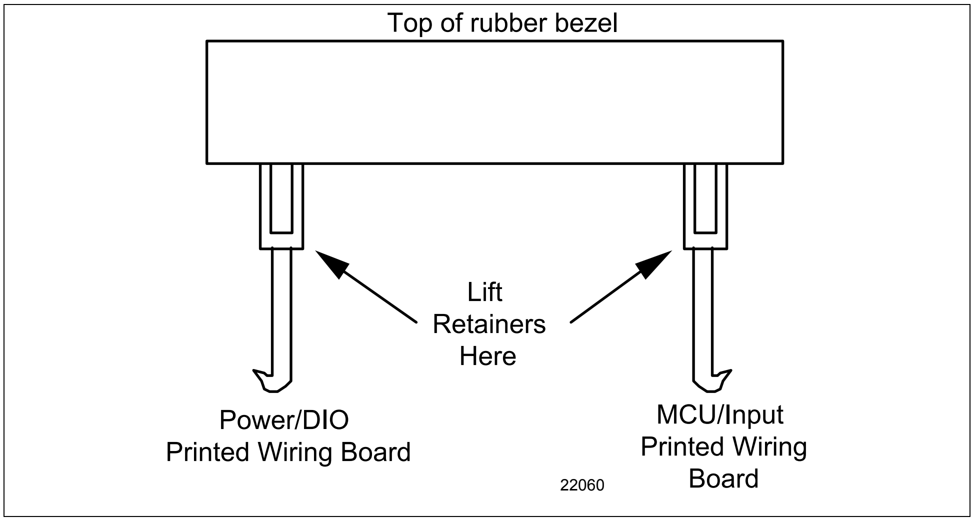
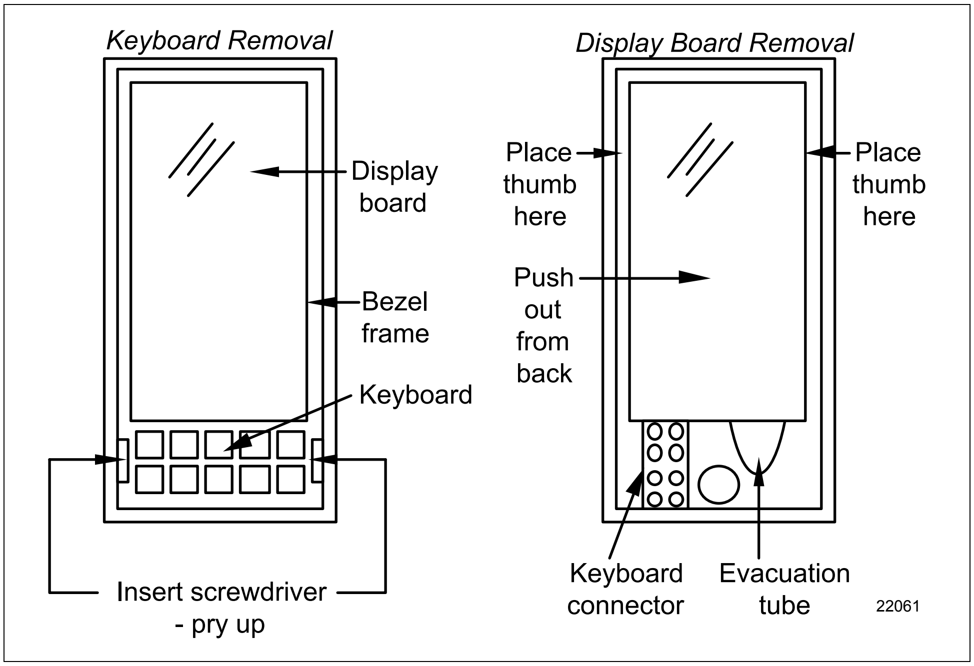


Figure 8-4 identifies the parts for Keyboard or Display removal.

Figure 8-4 Keyboard and Display Board Removal



Continued on next page

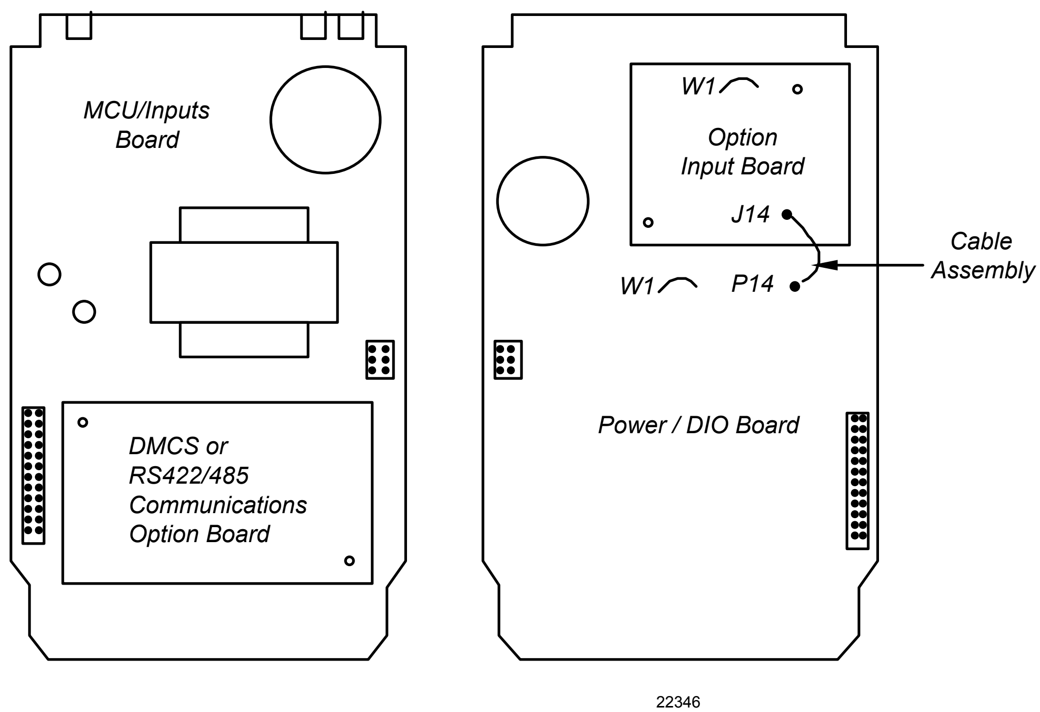
How to access the Printed Wiring Boards

Follow the procedure in Table 8-16 to access the Printed Wiring Boards.

Table 8-16 Access the Printed Wiring Boards.

Step	Action
1	Remove the chassis from the case as shown in Figure 8-1.
2	Follow the procedure in steps1A and 2A in Table 8-15 to remove the Bezel/Keyboard/Display form the chassis
3	Remove the four screws (two on each side) that hold the two main printed wiring boards onto the chassis (See figure 8-2 for location)
4	Use pliers to squeeze the ends of the spacer and push it through the Power/ Digital I/O PWB. (See figure 8-2 for location of spacer)
5	Gently pull the MCU/Inputs and the Power/Digital I/O boards apart out of the top and bottom interconnectors and lay the boards flat on a non-conductive surface. (See figure 8-5).
6	Figure 8-6 identifies the location of the Printed Wiring Boards.

Figure 8-5 Printed Wiring Board Identification



Continued on next page

How to replace the MCU/Inputs printed wiring board

To replace the MCU/Inputs printed wiring board (Part Number 51309176-002), follow the procedure listed in Table 8-17 and refer to Figure 8-5 for parts location.

Table 8-17 MCU/Inputs PWB Replacement Procedure

Step	Action
1	Remove the chassis from the case. (See Table 8-14).
2	Remove the Bezel/Keyboard and Display board (See Table 8-15).
3	Access the Printed Wiring Boards (See Table 8-16)
4	Identify the MCU/Inputs PWB and remove the Communications Option board if present (see Table 8-18).
5	Make sure the power select jumpers on the new board are in the proper location for the voltage desired (see Figure 8-6).
6	Reassemble the Communications Option PWB to the MCU/Inputs PWB if present.
7	Assemble the interconnects to the new MCU/Inputs board and reassemble the boards reversing the procedure in Table 8-16
8	Reattach the Bezel/Keyboard and Display board.

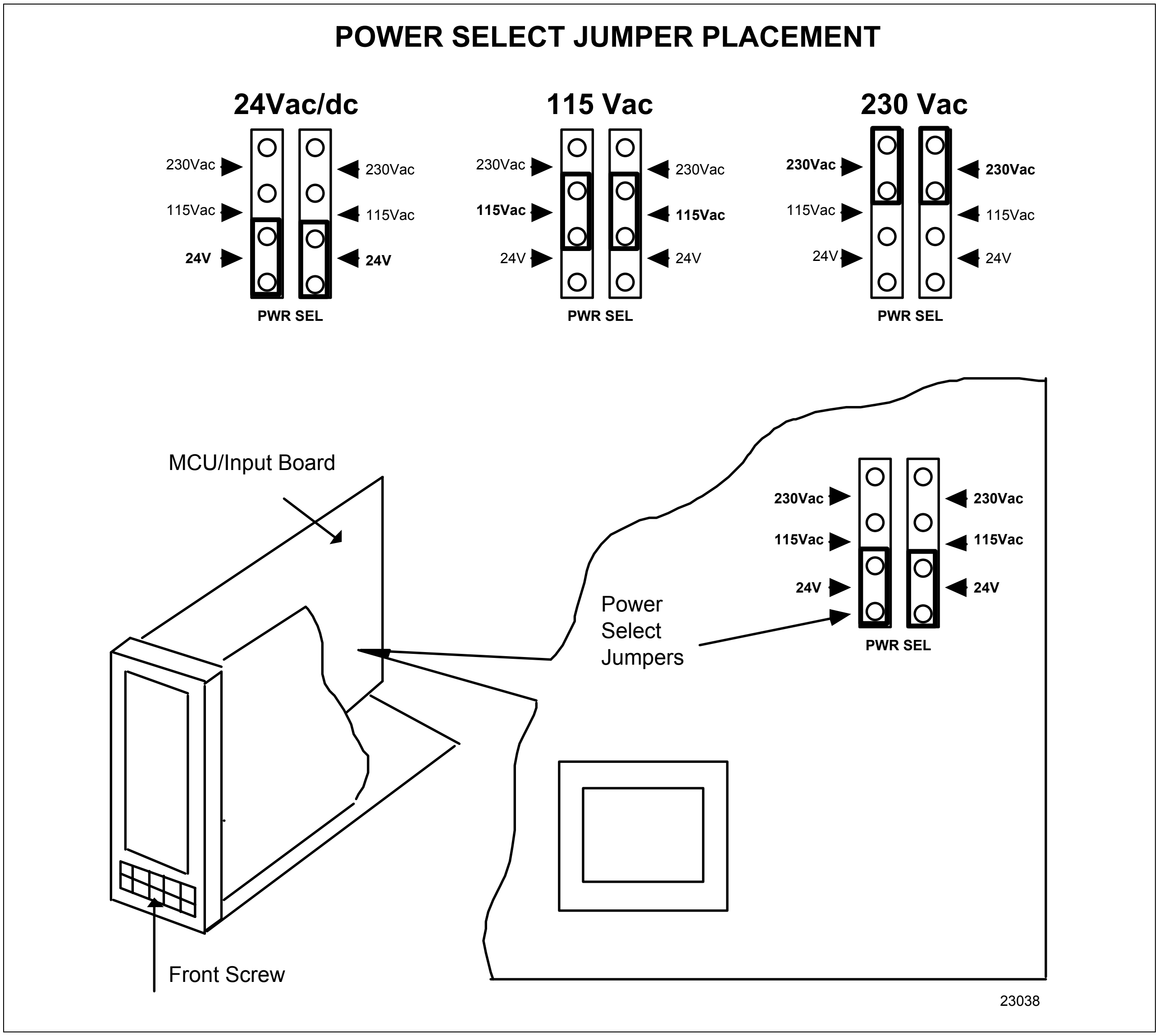
Continued on next page

How to replace the MCU/Inputs printed wiring board, continued

Figure 8-6 shows the location of the Power Select Jumpers on the MCU/Inputs Printed Wiring Board.

CAUTION **Applying the wrong power to the controller will severely damage the controller and is a fire and smoke hazard. Make sure the jumpers are set correctly.**

Figure 8-6 Power Select Jumper Location



Continued on next page

How to replace the communications option board

To replace the

- DMCS Communications option board (Part Number 30755408-503)
- RS422/485 Communications option board
  (Part Number 30755865-504)

Refer to Figure 8-5 for parts location and follow the procedure in Table 8-18.

Table 8-18 Communications Option Board Replacement Procedure

Step	Action
1	Remove the chassis from the case. (See Table 8-14).
2	Remove the Bezel/Keyboard and Display board (See Table 8-15).
3	Access the Printed Wiring Boards (See Table 8-16)
4	Identify the Communications Option board and remove the two screws that hold it onto the MCU/Inputs PWB
6	Assemble the new Communications Option PWB to the MCU/Inputs PWB.
7	Assemble the interconnects to the MCU/Inputs board and reassemble the boards reversing the procedure in table 8-16
8	Reattach the Bezel/Keyboard and Display board.

Continued on next page

How to replace the Power/DIO printed wiring board

To replace the Power/DIO printed wiring board (Part Number 51309179-002), follow the procedure listed in Table 8-19 and refer to Figure 8-5 for parts location.

Table 8-19 Digital I/O PWB Replacement Procedure

Step	Action
1	Remove the chassis from the case. (See Table 8-14).
2	Remove the Bezel/Keyboard and Display board (See Table 8-15).
3	Access the Printed Wiring Boards (See Table 8-16)
4	Identify the Power/DIO PWB and remove the Option Input board if present (see Table 8-20).
5	Replace U109 PROM on the MCU/Inputs board with the new PROM from the kit.
6	Reassemble the Option Input PWB to the Digital I/O-Power PWB if present.
7	Assemble the interconnects to the new MCU/Inputs board and reassemble the boards reversing the procedure in table 8-16
8	Reattach the Bezel/Keyboard and Display board.

Continued on next page

How to replace the option Input board

To replace the Option Input Board, refer to Figure 8-5 for parts location and follow the procedure in Table 8-20.

Table 8-20 Option Input Board Replacement Procedure

Step	Action
1	Remove the chassis from the case. (See Table 8-14).
2	Remove the Bezel/Keyboard and Display board (See Table 8-15).
3	Access the Printed Wiring Boards (See Table 8-16)
4	Identify the Option Input board . The board is attached to the Power/DIO board by mounting posts.
5	Use small pliers and squeeze the ends of each posts together and push it through the board.
6	Assemble the new Option Input PWB to the Power/DIO PWB. **ATTENTION** If you are using the Low Level Option Input board, Part Number 30756715-501, make sure that the W1 jumper on both the Option Input board and on the Power/DIO board are removed (See Figure 8-5). For the Pulse Option Input board, Part Number 51309184-501, **DO NOT** remove the W1 jumper.
7	Assemble the interconnects to the MCU/Inputs board and reassemble the boards reversing the procedure in Table 8-16
8	Reattach the Bezel/Keyboard and Display board.

8.9 Maintenance

Cleaning

If you find it necessary to clean the elastomer bezel, use mild soapy water.

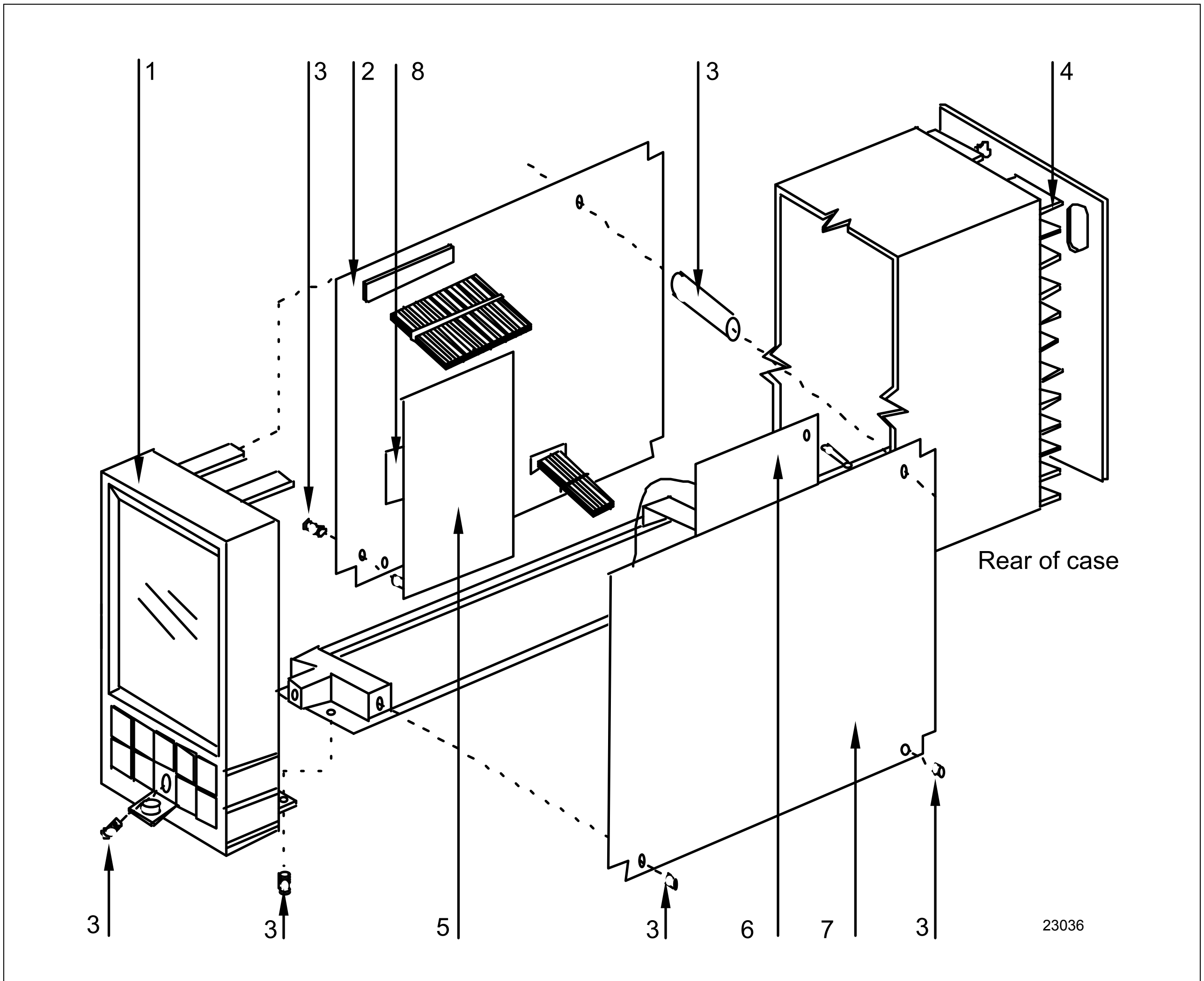
Section 9 – Parts List

9.1 Exploded View

Introduction

Figure 9-1 is an exploded view of the UDC 6300 Controller. Each part is labeled with a key number. The part numbers are listed by key number in Table 9-1. There is a list of parts not shown in Table 9-2.

Figure 9-1 UDC 6300 Exploded View



Continued on next page

Parts identification

Table 9-1 lists the part numbers for the key numbers shown in the exploded view.

Table 9-1 Parts Identification

Key Number	Part Number	Description	Quantity
1	30757071-501 30757007-501 30757010-501	Bezel/Keyboard/Display Printed Wiring Board Assembly Keyboard Switch Assembly (included in 30757071-501) Display Printed Wiring Board (included in 30757071-501)	1
2	51309176-504	MCU/Inputs Printed Wiring Board	1
3	30755498-005	Hardware Kit	1
4	30754499-003	Rear Connector Kit, includes: 2 - terminal Blocks, 13 Connector	1
5	30755408-503 30755865-504	DMCS Communications PWB RS422/485 Communications PWB	1
6	30756715-501 51309184-501	Input 5 PWB - Low Level Input Input 5 PWB - Pulse Input	1
7	51309179- 502	Power/DIO PWB	1
8	 51450900-501 51450900-502 51450900-503 51450900-504 51309350-501 51309350-502	Upgrade PROM Upgrade Adaptive Tune Upgrade Math & Adaptive Upgrade 2 Loops & Adaptive Upgrade All Options Upgrade Prom – TPS Upgrade Prom - Modbus RTU	1

Continued on next page

Parts not shown

Table 9-2 lists the part numbers of the parts not show in the exploded view.

Table 9-2 Parts Not Shown

Part Number	Description	Quantity
30755469-001	Standby Manual Module	1
30755515-001	Standby Manual Module Adapter Kit, includes: 1 - 30 inch long connector/cable Assy 1 - Connector Mounting Bracket 2 - Mounting Screws with Washers	1
30755498-001	4-20 mA Resistor Kit, 250 Ohms	1*
30755498-002	10–50 mA Resistor Kit, 100 Ohms	1*
30757088-501	Cold Junction Resistor Kit	1
30756505-003	Vutronik Mask Kit (Gray) - See table 9-3.	1
30756505-004	Vutronik Mask Kit (Gray) - See table 9-3.	
30755050-001	Mounting Kit	1
30754465-501	0 to 10V Range Voltage Divider	1
30755498-006	Power Select Kit	1
30755498-004	Fuse Kit	1

Vutronik mask kits

Table 9-3 lists the Gray Vutronik Mask Kit Part Numbers.

Table 9-3 Gray Vutronik Mask Kits

Vutronik Unit Cutout	Maximum Quantity of UDC6300 that will fit in Vutronik Cutout	Gray Vutronik Mask Kit Part Number	Quantity of Kits Required
1 Unit	0 (opening must be widened)	None	None
2 Units	1	30756505-004**	1
3 Units	2	30756505-003*	2
4 Units	2	30756505-004**	2
5 Units	3	30756505-003*	3
8 Units (Multi-unit Case)	5	30756505-003* 30756505-004**	4 1

* 30756505-003 contains:
1 Plate - 6.59 x 4.20 " Overall Size
1 Plate - 6.59 x 3.36 " Overall Size

** 30756505-003 contains:
2 Plates - 6.59 x 3.36 " Overall

Index

A

Aborting PV Adaptive Tuning, *206*
Aborting SP Only Tuning, *205*
Aborting Tuning, *201*
Accutune, *183*, *199*
ACCUTUNE, *79*
Accutune error codes, *207*
Accutune function., *79*
Accutune Rules and Regulations, *200*
Accutune Set Up group, *40*
Accutune Set Up Group, *40*, *41*, *79*
Accutune., 3
Adaptive tune - Loop 2 Available only if configured for 2Loop or Cascade., *80*
Adaptive tune error status, *81*
Advanced Math Parameters Set Up Group, *48*, *98*
Alarm Digital Output(s) failur, *263*
Alarm operation, *189*
Alarms, *189*
Alarms Set Up Group, *62*, *133*
Algorithm Data Set Up Group, *42*, *82*
Ambient Temperature, *8*
annunciator functions, *148*
Auto bias, *113*, *118*
Auto Manual Station mode
backup control feature, *212*
Auto/Manual Station, *212*
Auto/Manual Station mode, *212*
Auto/Manual Station Mode Configuration, *214*
Automatic Mode, *156*
Automatic switchover value, *112*, *117*

B

background tests, *257*
Bargraph indication for 2 loops, *181*
bargraphs, *149*
Baud rate, *129*
Bezel/Keyboard/Display Assembly Replacement Procedure, *269*
Bias, *107*
BOX MODE, *131*

C

Calib Group, *66*
CALIB RATE, *74*
calibrate Input 5 Pulse Inputs, *233*
Calibration procedure for Input. 5
CE Conformity, *1*, *8*
Characterizers, 3
Chassis Removal, *267*
Cleaning, *277*
Cold Junction Resistor, *12*
Cold Junction Temperature, *231*
Communication units, *130*
Communications, 3
Communications failure, *265*
Communications Group, *60*
Communications Option Board Replacement Procedure, *274*
Communications option connections, *26*
Communications selection, *128*
Communications station address, *128*
COMMUNICATIONS STATION ADDRESS, *128*
comparator gates, *187*
Composite wiring diagram, *17*
Computer Setpoint Bias, *131*
Computer Setpoint ratio, *131*
Configuration, *27*
Configuration Options - Digital Outputs 1 and 2, *190*
Configuration options - Digital Outputs 3 and 4, *190*
Configuration Procedure, *32*
Configuration Prompt Definitions, *71*
Configuration Record Sheet, *67*
Configuration Selections for Pulse Input, *209*
Configuration Tips, *31*
Control 2 algorithm, *85*
Control algorithm, *82*
Control Algorithms, *3*
Control Parameters Set Up Group, *111*
Controller dropoff value, *114*, *119*
Controller failure symptoms, *252*
Controller Failure Symptoms, *259*
CURRENT DUPLEX, *104*
Current Output, *22*
Current Proportional Output Calibration, *242*
Current Proportional Output failure symptoms, *261*
CURRENT SIMPLEX, *104*
CURRENT/TIME DUPLEX, *104*
Customer Support Phone Number, *252*
Cycle time, *73*
Cycle time 2, *73*

D

Deadband, *114*, *119*
decimal position, *147*
Demand Tuning, *40*, *199*
Demand Tuning + PV Adapt, *199*
Diagnostic error messages, *152*
Digital Display Indication - 2 Loops, *180*
Digital I/O PWB Replacement Procedure, *275*
Digital Input 1 and 2, *192*
Digital input 1 and 2 combination selections, *194*
Digital input 3,4,5,and 6, *196*
Digital Input and gate output priority, *191*
Digital input one selections, *122*, *125*
Digital inputs, *183*
Digital Inputs, *24*
Digital Inputs / Outputs, *2*
Digital Logic Gates, 3
DIGITAL OUTPUT STATUS, *105*
Digital Outputs, *25*
Digital Outputs 1 and 2, *190*
Digital Outputs 3 and 4, *190*
Dimensions, *13*

Index

Direct acting control, *114*, *118*
Direct Digital Control), *131*
Display Parameters Set Up Group, *65*, 138
Displaying Functions, *31*
Displaying Groups, *31*
Displays and indicators, *4*
Dual Loop / Internal Cascade, 3
Duplex (Heat/Cool), *202*, *204*

E

eight segment characterizer, *92*
eight segment characterizer, *91*
Eight Segment Characterizer, *97*
Electrical considerations, *12*
Electrical noise, *15*
Emissivity, *110*
Error messages, *251*
Error prompt, *207*
Exiting SET UP mode, *31*

F

Factory calibration, *236*
Failsafe mode, *115*, *119*
Failsafe output value, *115*, *119*
FEEDFORWARD MULTIPLIER, *89*
FEEDFORWARD SUMMER, *87*
FILTER, *107*
Filter for input 5, *109*
Flow Totalizer, *186*
Frequency Input, *208*
Function of keys, *5*
Function Parameter, *32*
Fuzzy Overshoot Suppression, *40*, *198*
FUZZY OVERSHOOT SUPPRESSION, *79*

G

Gain, *72*
Gain 2, *73*
Gain Scheduling, 3
GAIN VAL 1, *75*
Gate configuration, *187*
Gate Operation, *187*
Get Started, *30*
grounding, *12*

H

High level input connections, *19*
High output limit, *114*, *119*
HIGH SCALING FACTOR, *89*
HIGH SELECT, *88*
How to access the Printed Wiring Boards, *271*
How to remove the chassis, *267*
How to replace Bezel/ Keyboard/Display assembly,, *269*
How to replace the communications option board, *274*
How to replace the MCU/Inputs printed wiring board, *272*
How to replace the option Input board, *276*
How to replace the Power/DIO printed wiring board, *275*

I

Input. 5 - Pulse Input Calibration Procedure. 5
  Calibration Procedure
Input 1 Through 4 Parameters Set Up Group, *52*, *106*
Input 5 - Low Level, *12*
Input 5 - Pulse Input, *208*
Input 5 high range value, *109*
Input 5 low range value, *109*
Input 5 Parameters Set Up Group, *53*, *108*
Input 5, Low level Input Connections, *20*
Input 5-Pulse Inputs, *21*
Input algorithm selections, *184*
Input Calibration, *217*
Input high range value, *106*
Input low range value, *107*
Input Math algorithms, *82*
Input Math Algorithms, *184*
Inputs, *2*
Installation, *7*
  Operating limits, *8*
integration rates, *186*
Internal Cascade control:, *172*
Internal cascade indication, *182*

K

K CONSTANT FOR MATH SELECTIONS, *89*
Key Error, *31*
Keyboard failure, *264*
keyboard test, *264*
Keys, *5*

L

Latching or Non-Latching Alarm Outputs, *189*
Line voltage wiring, *18*
Local Loopback Test, *265*
Local setpoint change, *159*
Local setpoint source, *112*, *117*, *158*
Lockout, *74*
Logic Gate function, *187*
Logic Gates, *48*, *98*
Logic Gates Constraints, *x*, *188*
Loop 1 Control Parameters Set Up Group, *54*
Loop 2 Control Parameters Set Up Group, *56*
Low output limit, *114*, *119*
LOW SCALING FACTOR, *89*
LOW SELECT, *88*

M

Manual Mode, *156*
Manual reset, *73*
Mass Flow Compensation, *95*
Math Options, 3
MAX IMUM, *74*

MCU/Inputs PWB Replacement Procedure, *272*
Mechanical Shock, *8*
Model Number, *14*
Model number interpretation, *9*
Monitoring two individual loops of control, *180*
Mounting
  Overall dimensions, *13*
Mounting procedure, *14*
MULTIPLIER, *88*
MULTIPLIER WITH SQUARE ROOT, *88*
MULTIPLIER DIVIDER, *88*
MULTIPLIER DIVIDER WITH SQUARE ROOT, *88*

N

Non-Latching alarms, *189*

O

Operating Mode, *154*
Operating parameters, *150*
Operating parameters, continued, *151*
Operation, *143*
Operation of two individual loops of control, *183*
Operator Interface, *4*, *147*
Option Input Board Replacement Procedure, *276*
Optional Input 5, *20*, *21*
Options, *3*
Options Set Up Group, *58*, *120*
OUTPUT (OP) POINT ADDRESS, *129*
Output 1 tracks input 4, *122*
Output 2 tracks input 4, *123*
Output algorithm, *104*, *105*
Output algorithm and alarms priority, *191*
Output Algorithm Parameters Set Up Group, *51*
Output Algorithms, *2*
Output Calibration, *241*
Output change rate, *114*, *118*
Output Overrid, *82*
Output Override, *86*, *183*
Output rate down value, *114*, *119*
Output rate up value, *114*, *119*
Outputs, *2*
Override Selector, *176*
Overshoot Suppression, *79*
Overview, *1*

P

Parity, *129*
Parts Identification, *268*
Parts Replacement Procedures, *266*
PD with manual reset, *83*, *86*
Physical considerations, *13*
PID A, *83*, *85*
PID B, *83*, *85*
PID loop selection, *85*
Polynomial Curve Characterizer-, 3
Polynomial Equation, *93*, *185*
Power, *8*
Power Consumption, *8*
power failure symptoms, *260*
Power Select Jumper Location, *273*
Power select jumper placement, *11*
power select jumpers, *10*
Power up, *144*
Power up controller mode recall, *113*
Power-up Tests, *253*
Precision resistor, *231*
Precision Resistor, *12*
Pre-installation information, *8*
Preliminary Installation Procedure, *10*
Printed Wiring Board Identification, *271*
Priority level for digital outputs, *191*
Process gain Loop 2, *80*
PROCESS VARIABLE (PV) POINT ADDRESS, *129*
Process Variable Source, *111*
Prompt hierarchy, *28*
Proportional band, *72*
Proportional band 2, *73*
Proportional band units, *115*
Protective bonding, *12*
pulse input, *208*
Pulse Input, *208*
PV Tuning, *40*
PV tuning indications, *206*

R

Rate 2, *73*
Rate action,, *72*
Rate down, *78*
Rate up, *78*
Relative Humidity, *8*
Remote Cascade, *131*
Remote setpoint source, *112*, *117*, *162*
Remote switching, *192*, *196*
Replacement Parts Identification, *268*
Reset, *73*
Reset 2, *73*
Reset units, *115*
Restoring factory calibration, *236*
Restoring to the original value, *31*
Reverse acting control, *114*, *118*

S

Scrolling, *31*
Second Current Output, 3, 23, 245
security code, *146*
Security code, *74*
Security Code, *146*
Selecting Manual or Automatic mode, *156*
Selecting the Number of PID Loops, *82*
Set Up groups, *31*
Set Up mode, *32*
Setpoint high limit, *113*, *118*
Setpoint low limit, *113*, *118*
Setpoint ramp, *77*
Setpoint Ramp
  Configuring, *166*
  Running, *167*

Index

Setpoint ramp final setpoint, *77*
Setpoint Ramp Set Up group, *39*
Setpoint ramp time, *77*
Setpoint Ramp/Rate Set Up Group, *77*
Setpoint rate, *39*, *78*
Setpoint selection indication, *164*
Setpoint tracking, *118*
Setpoint Tracking, *113*
Setpoint Tuning, *199*
Setpoint Tuning+ PV Adapt, *199*
Shed controller mode and output level, *131*, *132*
Shed setpoint, *131*, *132*
Shed time, *131*
Shock hazard warning, *249*
Single Setpoint Ramp, *39*
Software version, *252*
SP Only tuning, *203*, *205*
SP Only Tuning for Duplex (Heat/Cool), *204*
SP Only tuning, *203*
SP Tuning, *40*
Standard inputs range selection, *12*
Status Grou, *66*
status tests, *254*
SUMMER WITH RATIO AND BIAS, *88*
Supervisory Control, *131*
Switchover value, *170*

T

Technical Assistance, *iii*
The Three Position Step Control, *210*
THREE POSITION STEP, *84*
TIME DUPLEX, *104*
Time Proportional Digital Output(s) failure, *262*
Time Proportional Output, *104*
TIME SIMPLEX, *104*
Timing out from Set Up mode, *31*
totalizer displays, *186*
totalizer function, *94*
Totalizer function, *186*
Totalizer Function -, 3
Transmitter characterization, *106*
Transmitter Power, 3
Transmitter Supply, *8*
Troubleshooting / Service, *249*
Troubleshooting Aids, *251*
troubleshooting procedures, *260*
TUNE, *79*, *201*
TUNE (Demand, 201
TUNE for Duplex (Heat/Cool), *202*
Tuning L2 Set Up group, *37*
Tuning parameter sets, *111*, *116*
Tuning Parameters Set Up Group, *72*
Tuning Set Up group, *34*
Two 8-Segment Characterization, *185*
Two loop and cascade operation, *199*

V

Vibration, *8*
Voltage Divider Assembly, *12*

W

WARNING—SHOCK HAZARD, *249*
Warranty, *iii*
Wiring
  Electrical noise precautions, *15*
  Wire bundling, *15*
  Wiring the controller, *16*

Honeywell

Industrial Measurement and Control
Honeywell Inc.
1100 Virginia Drive
Fort Washington, PA 19034